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SHUTTLE ACTIVE THERMAL CONTROL SYSTEM DEVELOPMENT TESTING

VOLUME V

INTEGRATED RADIATOR/EXPENDABLE COOLING SYSTEM TESTS

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VOUGHT SYSTEMS DIVISION
LTV AEROSPACE CORPORATION

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SYSTEM DEVELOPMENT TESTING

VOLUME V

INTEGRATED RADIATOR/EXPENDABLE COOLING
SYSTEM TESTS

Report No. T169-28

15 April 1974

Submitted By

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To

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FOREWORD

This volume is one of a series of reports describing the development tests conducted on a candidate Shuttle heat rejection system at the National Aeronautics and Space Administration - Johnson Space Center during the period from March to July 1973. The complete test series is reported in the following volumes:

| | |
|-------------|---|
| Volume I | Overall Summary |
| Volume II | Modular Radiator System Tests |
| Volume III | Modular Radiator System Test Data Correlation with Thermal Model |
| Volume IV | Modular Radiator System Test Data |
| Volume V | Integrated Radiator/Expendable Cooling System Tests |
| Volume VI | Water Ejector Plume Tests |
| Volume VII | Improved Radiator Coating Adhesives Tests |
| Volume VIII | Tube Anomaly Investigation |

The tests were conducted jointly by NASA and the Vought Systems Division of LTV Aerospace Corporation under contract NAS9-10534. D. W. Morris of the NASA-JSC Crew Systems Division was the contract technical monitor. R. J. Tufte served as the VSD Project Engineer.

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1.0 SUMMARY

A one-week thermal vacuum test was conducted at NASA's Johnson Space Center(JSC) between 30 April and 4 May 1973. The purpose of this test was to gather data on a Space Shuttle Active Control System (ATCS) incorporating both radiators and an expendable cooling device to provide vehicle heat removal. Two such systems were tested, for a total of 49 hours, and design information was provided for both nominal and limit conditions.

The test verified the concept that an integrated radiator/expendable cooling system can adequately maintain desired water quantities while responding to variations in heat loads and environments. In addition, the need for duct heating was demonstrated, while exhaust nozzle heating was shown to be unnessecary.

2.0 INTRODUCTION

This report presents the results of a one-week test program of two integrated active thermal control systems for the Space Shuttle Orbiter. The test was conducted in Chamber A of the JSC Space Environment Simulation Laboratory (SESL) between 30 April and 4 May 1973.

The heat rejection systems tested consisted of a modular radiator system (MRS) of eight 6' x 12' radiator panels constructed by the Vought Systems Division (VSD) of LTV Aerospace Corporation, and two expendable cooling devices: (1) a flash evaporator designed and fabricated by VSD and (2) an Apollo-type sublimator (used on the Lunar Module) built by the Hamilton Standard Division (HSD) of United Aircraft. First the FE, and then the sublimator, were tested in series with the MRS, creating two "integrated" systems. Each system was designed to reject expected Shuttle heat loads and to provide efficient use of the excess water produced by the vehicle's fuel cells.

2.1 Background of "Integrated" ATCS

The concept of using both radiators and expendable cooling to provide a minimum weight ATCS derived from a study performed by VSD for the Crew Systems Division (CSD) of JSC.

This study explored the possibility that by adding expendable cooling to the radiator system, the reduction in required radiator area would provide a decrease in overall weight which would more than offset the extra weight of the expendable cooling device. The results of the study indicated that this integrated system concept did provide a smaller launch weight for the Orbiter.

The attractiveness of expendable cooling is due to the substantial amount of excess water that is produced by the fuel cells. This water production is shown in Table 1 for various mission phases, along with projected heat loads appropriate to each phase. The excess water must be expelled from the vehicle to reduce the launch weight of the storage tankage, but if it is expelled through an expendable cooling device such as a flash evaporator, the radiator area requirement is lessened.

Thus, the integrated ATCS involves launch with sufficient water to assist a "smaller" radiator during the peak load period early in the mission, followed by use of the expendable device in a "water management" mode to maintain onboard water at an optimum level to accommodate peak loads toward the end of the mission.

Figure 1 shows launch weight as a function of radiator area for four candidate radiator configurations shown in Figure 2. From Figure 1 it can be seen that configuration 4 offers minimum launch weight for a radiator which approximately covers the forward 30 feet of the cargo bay doors. This configuration is simulated with the MRS test article as shown in Figure 3. This test configuration is identical to the "Y" configuration of the MRS testing described in Volume II.

2.2 Test Objectives

The key objectives of the test can be summarized as follows:

- o System verification and sensitivity
- o Component performance data gathering
- o Nozzle and duct heater investigation
- o Mechanical, manufacturing suitability

TABLE 1

TYPICAL ORBITER HEAT LOADS AND WATER PRODUCTION RATES

| <u>Mission Phase</u> | <u>Duration(hrs)</u> | <u>Net Water Production(lb/hr)</u> | <u>Heat Rejection Required(BTU/hr)</u> |
|----------------------|----------------------|--|--|
| Ascent | 1 | 9.7 | 70,000 |
| Coast-Adjust | 21 | 7.1 | 42,000 |
| Rendezvous | 7 | 11.4 | 70,000 |
| Station Keeping* | 131 | 4.9 | 31,000 |
| Station Keeping** | 131 | 8.9 | 57,000 |
| Undocking | 4 | 11.6 | 57,000 |
| Reentry | 1 | 9.7 | 70,000 |

* assuming 1.5 kw payload heat rejection required

** assuming 6.0 kw payload heat rejection required

Since it had been demonstrated analytically that a weight savings could result from an integrated concept, it was desired to test the suitability, sensitivity, and limits of the control system designed to "allocate" heat rejection between the radiator and the expendable device while maintaining desired water levels. To this end, a limit condition series of tests were run to attempt to deplete and overfill the tank and to cause the control system to chatter. Also, typical mission profiles were run to gather response data on orbital transient situations.

The comparison of the flash evaporator and the sublimator as potential candidates for selection as Shuttle flight hardware was another major objective of the test. In order to make this comparison, the test sequence of the two devices was basically identical.

The supersonic nozzles on each expendable cooling device are intended to direct the effluent vapor plume away from the Shuttle in such a way that the vapor does not scatter back onto surfaces that might be contaminated. Nozzles were designed to minimize this backscatter, and the chamber was instrumented to measure the extent of the vapor plume. Insufficient data was obtained in this system test, however, subsequent nozzle component tests were conducted to accomplish this objective. Plume definition and backscatter minimization is the subject of Volume VI.

The general mechanical and manufacturing suitability of the various components of the ATCS was also an objective of all phases of the testing. This also includes verification of procedures such as startup and shutdown of devices and stagnation and destagnation of radiator panels. This objective is discussed further in the conclusions section of this volume.

3.0 TEST ARTICLE AND INSTRUMENTATION

Figure 4 is a simplified schematic of the integrated ATCS. The system is made up of the following components:

- o Modular Radiator System
- o Expendable Cooling Device w/Supersonic Nozzle
(either Flash Evaporator or Sublimator)
- o Water Storage System

Each of these component subsystems will be described in the following paragraphs.

3.1 Modular Radiator System

The MRS for this test consisted of eight 6 ft x 12 ft flat panels arranged in flow patterns similar to those being considered for the Space Shuttle. Each panel consists of extruded tubes welded to 0.02 aluminum sheet on 6.0 inch centers in a U-shaped pattern as in Figure 5. The over/under tube arrangement (Figure 5) provides for completely redundant flow passages, but only the "under" passage was used in this test. Thorough thermal vacuum testing of two of the panels has previously been performed and all eight panels and the flow bench were checked out in the VSD thermal vacuum chamber prior to the MRS Chamber A tests to insure satisfactory operation of all equipment and verify all operational procedures. The panels operated flawlessly for three weeks during the MRS testing (Volume II).

The eight panels were installed in Chamber A as shown in Figure 6.

MRS outlet temperature control is maintained by varying the flow split between the "prime" circuit and the "tank" circuit. This flow

split is controlled by a mixing valve which senses the mixed outlet temperature and compares it to a predetermined set point temperature. During periods of low load, the majority of the Freon flows through the prime tubes of each panel, and the bank was allowed to stagnate (freeze), thus reducing the effective panel area. As the load is increased, more flow is routed to the bank, and the panels begin to destagnate (thaw) from the inside out (i.e., the shortest tubes destagnate first).

The mixing valve used for radiator/flash evaporator testing was an electromechanical valve and control unit originally designed for use in the Skylab Apollo Telescope Mount (ATM) coolant loop. The valve control unit was modified by VSD to provide outlet temperature control points of 40°, 50°, and 70°. The Skylab requirement for leakage through the ATM valve "closed" side is much higher than that required for MRS testing. Thus, additional restriction was added manually by VSD test personnel during various phases of the test, such that the leak rate was reduced to approximately 1% of full flow.

The mixing valve planned for use with the radiator/sublimator system was an HSD valve with two set points: 40°F and 70°F. This valve developed oscillations during the test and was replaced by the ATM valve and manual control of set point.

The environment was simulated by a temperature controlled panel located immediately below the radiator panels as indicated in the sketch of Figure 3. A Freon 11 loop and a liquid nitrogen loop flowing in separate tubes were used to control the panel temperatures. Design, installation and operation of the environment panels were provided by the

Space Environment Simulation Laboratory division of NASA-JSC. The radiator panel absorbed heat was determined by SESL engineers based on the simulator and radiator temperatures, including the effect of reflected energy.

3.2 Flash Evaporator

The flash evaporator is a heat transfer device in which water evaporates in contact with the inside surface of a heat exchanger while Freon circulates on the outside surface. Figure 7 is a cutaway drawing of the device that was used for integrated testing.

The water is sprayed into the chamber on command from a sensing thermocouple located adjacent to one of the freon tubes. For these tests, the control temperature was 40°F, which caused water spray (and heat rejection) whenever the Freon temperature was greater than 40°F. The spraying nozzle is designed to flow 16 lb/hr for a full open evaporant valve, although for heat loads less than 16,000 Btu/hr, the action of the thermocouple causes a rapid pulsation of spray. Only at inlet temperatures of 70°F or above will the FE spray water continuously at 16 lb/hr.

The FE is designed to maintain Freon outlet temperatures at 40°F for a range of inlet temperatures from 40° to 70°F.

3.3 Sublimator

The HSD sublimator is a device which depends for operation on the formation of an ice layer between the feedwater supply and the chamber vacuum. With the addition of heat from the Freon system, the ice layer is continuously sublimated to space while new ice is formed beneath

(see Figure 8). The action of the ice layer is such that "automatic" water demand is created in proportion to the heat rejected.

The sublimator package was designed to reduce Freon temperature from a maximum of 70°F to 40°F, at high load conditions. For inlet temperatures above 70°F, ice is sublimated faster than it can be formed, a condition which will eventually lead to a "breakthrough," in which water is boiling into the vacuum. When this occurs, the heat load must be removed and a "dryout" period commenced, followed by the reestablishment of the ice layer.

3.4 Supersonic Nozzles

Each device was fitted with a six-foot duct with two 45° bends, simulating a typical shuttle routing. In addition, a supersonic nozzle was mated to each duct in order to assess the degree of backscatter onto the orbiter surface. The nozzles were designed by personnel of the Propulsion and Power Division (PPD) of JSC, and these PPD engineers also had primary responsibility for defining the vapor plume via particle counters located at various points in the chamber.

Both ducts and both nozzles were heated to prevent ice buildup. The ducts were heated by routing Freon flow around them, as shown in Figure 9. The nozzles were fitted with electrical heaters. Figure 9 also shows a comparison of the size requirements of the two nozzles. Figure 10 is a picture of the nozzles prior to installation.

The difference in size between sublimator and FE ducts is due to the different pressure ranges required for operation of these devices. The sublimator requires a pressure in its plenum below the triple point of

water, while the FE operates at higher pressure. The higher pressure in the FE plenum allows the duct and nozzle to be smaller for the same mass flow rate.

3.5 Water Storage System

This system controls the amount of water stored by sensing the current level in the water tank and modifying the MRS set point temperature, which in turn modifies the water demanded by the FE or sublimator. The purpose of this arrangement is to efficiently manage the excess fuel cell water by using it as a heat sink in an optimally weight-effective manner. Use of this water provides a reduction in the radiator area requirements.

In effect, at peak heat rejection loads, both radiator and evaporative heat sink are needed to reject the load, and the system design point is to provide just enough radiator area such that at the worst environmental extreme, the peak load can be rejected. At lower loads, the evaporative device is used to maintain tank water level between 85 and 95% full, and the MRS is used as required.

The interaction between MRS and evaporative device is provided by the tank quantity meter and its effect on set point. This is shown in Figure 11. As an example of this interaction, if the tank is only 85% full, the radiators are asked to provide a low (40°) set point, which, in turn, causes the evaporative device to turn off (i.e., use no water). Thus the tank begins to fill. Conversely, if the tank is at its high-water mark, a high MRS set point is signalled and water is used by the evaporator, thus rejecting heat and lowering the tank level.

The water tank was filled with a fuel cell simulator controlled by the test director. The simulated fuel cell water flow rate was keyed with simulated heat load as per Table 1.

3.6 Instrumentation

Figure 12 is a system schematic which shows the positions of the temperature, pressure, and flow measuring devices on the sublimator, flash evaporator and their associated plumbing. The thermocouples located on each radiator panel can be identified by reference to Volume II of this report.

Appendix III is a complete record of all test data for the duration of the test. Those measurements that were of particular importance are the flash evaporator inlet and outlet Freon temperatures, water and Freon flow rates, and the pressure readings inside the evaporation chambers of each device.

4.0 TEST DESCRIPTION

The week-long test was divided into two major divisions, each of which was further subdivided into three major subdivisions, as follows:

- o Radiator/Evaporator System
 - o Design limit test points
 - o Mission profile test points
 - o Nozzle/duct heater test points
- o Radiator/Sublimator System
 - o Design limit test points
 - o Mission profile test points
 - o Nozzle/duct heater test points

As originally intended, the radiator/evaporator and radiator/sublimator test sequences were to be identical, although various facility problems caused significant deviations from the planned procedure.

Tables 2 and 3 show the test points completed. The following subsections discuss the two major groupings independently, with complete test data being provided in Appendix III. In Section 5.0, the results of the testing are summarized and discussed.

4.1 Radiator/Evaporator System

During the early stages of flash evaporator startup, a problem was detected in the system which supplies water to the spraying nozzle. This problem was diagnosed as being due to entrapped air in the water line between the water tank and the flash evaporator, a condition which prevented full water flow to the nozzle on demand. The problem was overcome by closing the supply valves and opening the evaporator valve to chamber

TABLE 2
RADIATOR/EVAPORATOR TEST SEQUENCE

| TEST POINT | TIME(hrs) | | RADIATOR INLET TEMP (°F) | FLOW TO H ₂ O TANK (lb/hr) | AVERAGE | | REMARK |
|---------------|-----------|----------|--------------------------------|---|--|--|--|
| | BEGIN | END | | | FLUX ON RADIATORS (BTU/hrft ²) | | |
| 1 | 120/1812 | 2035 | 161 | 12.0 | 5 | | |
| 2 | 2035 | 2300 | 161 | 12.0 | 5 → 140 | | Stability problems with flux simulator |
| 3 | 2300 | 2335 | 151 | 11.0 | 140 | | |
| 4 | 2335 | 121/0055 | 113 | 7.1 | 140 | | |
| 5 | 0055 | 0200 | 68 | 2.5 | 140 | | |
| 6 | 0200 | 0309 | 52.3 | .9 | 140 | | |
| 7 | 0309 | 0430 | 52.3 | .9 | 130 | | |
| 8 | 0430 | 1410 | 69 | 2.5 | 130 | | Rapid valve changes |
| 9 | 1410 | 1706 | 52 | 1 | 16 | | Rapid valve changes |
| 10 | 1706 | 1853 | 52 → 86 | 12 | 16 | | Overfill test point |
| 11 | 1853 | 1917 | 86 | 12 | 16 | | Manual tank reduction |
| 12 | 1917 | 2205 | 122 | 8 | Cycling | | Mission Simulation |
| 13 | 2205 | 2246 | 166 | 12.5 | | | |
| 14 | 2246 | 122/0000 | 115.2 | 7.3 | | | |
| 15 | 0000 | 0100 | 147.4 | 10.5 | | | |
| 16 | 0100 | 0145 | 115.2 | 7.3 | | | |
| 17 | 0145 | 0230 | 104.3 | 6.2 | | | |
| 18 | 0230 | 0400 | 115 | 7.3 | | | |

TABLE 2 (Continued)

[illegible]

TABLE 3
RADIATOR/SUBLIMATOR TEST SEQUENCE

| TEST POINT | TIME(hrs) | | RADIATOR INLET TEMP (°F) | FLOW TO H ₂ O TANK (lb/hr) | FLUX ON RADIATORS (BTU/hrft ²) | REMARK |
|---------------|-----------|------|--------------------------------|---|--|--------------------------|
| | BEGIN | END | | | | |
| 24 | 123/1350 | 1509 | 141 | 1 | 135 | |
| 25 | 1509 | 1533 | 106 | 6.7 | 135 | |
| 26 | 1533 | 1600 | 69 | 3.2 | 135 | |
| 27 | 1937 | 2101 | Ramp 50 → 85 | 12.2 | 60 | Overfill test point |
| 28 | 2101 | 2115 | 85 | 12.2 | 60 | Manual tank reduction |
| 29 | 2115 | 2139 | 118 | 8.2 | Cycling | Mission Simulation |
| 30 | 2139 | 2215 | 118 | 12 | ↓ | |
| 31 | 2215 | 2300 | 165 | 16.5 | | |
| 32 | 2300 | 2358 | 53 | 5 | | |
| 33 | 124/0003 | 0035 | 145 | 5 | | |
| 34 | 0330 | 0448 | 98 | 1.5 | | |
| 35 | 0448 | 0600 | 147 | - | 130 | Nozzle heater off |
| 36 | 0600 | 1030 | 147 | - | 130 | Duct heat off |
| | | | | | | |

vacuum and allowing the lines to boil free of water and air. This procedure was successful, and evaporator pre-ops were completed at 1620 of the first day, after a delay of approximately 4 hours.

An additional problem was detected and circumvented during the pre-ops period. Two of the 8 pumps which circulate F11 to the IR panels failed. These pumps were those which controlled IR panels 3 and 4. A deviation was written to supply panels 3 and 4 with liquid nitrogen, a change which caused the average IR flux on these panels to be 5 - 10 Btu/hr-ft² rather than 25 Btu/hr-ft² as originally planned. This difference was deemed inconsequential to the primary objectives of the integrated test, due to the previously demonstrated capacity of the MRS to provide 40° mixed outlet temperature with skewed environments.

Following the purging of the water supply line, test point 1 was completed. Test point 2 called for an inlet temperature of 162°F and a flux level which increased from 25 Btu/hr-ft² to 150 Btu/hr-ft². At the high end of the ramp, two problems developed concurrently: (1) the MRS return temperature was greater than 70° at the high flux value, and (2) the IR zones became unstable around 150 Btu/hr-ft², and fluctuated between 130 and 165 BTU/hrft.² The decision was made to drop the flux value back to 140 Btu/hr-ft², a value which allowed a 70°F return and which could be maintained in a stable configuration. For the remainder of test point 2 and test point 3, the lower value of flux was used. The evaporator thus saw an inlet temperature of 70°F as planned.

Test points 3 to 7, and part of 8 were completed before a major delay was incurred due to a frozen water supply line. This condition was first detected by observation that the FE water flow valve was apparently open, yet FW0002 was reporting no water flow. Reference to Figure 12 will clarify the following explanation of the anomaly.

The insulated water lines pass through the chamber and through an LN₂ shroud, and are then wrapped with a 1" wide heater wire and insulated. There is a short, unheated section of line before the lines pass into the FE enclosure. The line heaters control to a set point sensed in the fluid at the outlet of the heated section. There were other thermocouples and pressure transducers in the unheated section.

The responses taken to clear the frozen water lines were as follows:

- (1) all radiator flow was directed to the prime tube circuit, and thus entered the FE enclosure at an elevated temperature;
- (2) the heater controllers for the water supply lines were set to 200°F;
- (3) both primary and secondary FE valves were opened in order to identify the first thawed system.

Once the system thawed, the FE performance remained erratic for about an hour, due probably to ice formation during the thawing period. Proper operation was restored by maintaining high heat via hot Freon and running at a full 16 lb/hr water flow. The residual ice was apparently vaporized by this process, and the test continued.

The exact location of the frozen line was not determined. In subsequent tests, a high flow water jacket replaced the insulated heater. It is felt that this problem, and the subsequent erratic operation should be considered failures of facility test hardware and are not indicative of probable flight situational problems.

The test proceeded normally through test points 8,9,10 and 11 which completed design limit test profiles. Test points 12 through 20 were intended to verify mission profile operation, and were completed with only minor facility problems. The IR environment seen by the MRS panels was cycled between 50 Btu/hr-ft² and 160 Btu/hr-ft², or roughly representative of an orbit with a $\phi = 0^\circ$, 270 n.m., and an earth oriented, cargo bay-to-earth attitude. The environment provided matched closely that desired.

The final three test points (21, 22, 23) tested the necessity of the (1) electrical heating elements in the nozzle, and (2) F21 routing to warm the duct. First the nozzle heaters were turned off, followed by an observation period. Then, the F21 was bypassed around the duct, and performance was observed. Following this, heat was restored to both duct and nozzle, and the resulting restart was observed.

During various times in the test sequence, there were delays due to the plume instrumentation becoming overloaded with ice particles. During the desaturation period, the FE was off (so no more moisture was put into the chamber) and heat was applied to the gauges. Visual observation of the plume was attempted at various times throughout the test. In no case was a visible effluent from the FE nozzle observed, nor was there any evidence of ice formation in the region of the nozzle.

4.2 Radiator/Sublimator System

The sublimator performance was hampered during the test by frozen input water lines, just as the FE had been. In the case of the sublimator,

the delay occurred at startup (1525, day 122) and was not resolved for approximately 22 hours (1338, day 124), causing a drastic foreshortening of the test time, and a subsequent revision of later tests to recover much of the lost test time.

As was the case with the FE, the sublimator problems discussed herein are not deemed significant in terms of the Shuttle vehicle configuration, but are purely the result of having to route water lines through the deep space simulation chamber.

The procedures for thawing the sublimator water line were similar to those discussed for the FE, with high heat being applied both via F21 and line heaters. In addition, the water line was disconnected between valves 204 and 205 (refer to Figure 12), with valve 205 closed. Upon disconnection, a surge of steam issued from the line passing into the chamber. Furthermore, valve 205 was then opened, and more steam blew out the disconnected pipe, although no surge in chamber pressure was noted. The frozen segment was thus isolated to that portion of the line downstream of valve 205.

When flow was established to the sublimator, a "breakthrough" condition was indicated. This is probably due to the large surge of water which accompanied the final thawing. The water line was again disconnected outside the chamber, and air was allowed to blow into the chamber through the sublimator, carrying with it the excess water in the sublimator. With the system reconfigured for a normal startup, the sublimator operated properly, an ice layer was formed, and the test timeline was begun.

For the remainder of the test, the sublimator was subject to periodic losses of flow at low load conditions, a situation which was remedied by immediately increasing the Freon inlet temperature to the device. The cause of this flow stoppage was possibly due to freezing of the water line in the exposed section, although this was not verified. In all cases, an increase of Freon temperature to 53⁰ F reestablished water flow.

With the foregoing constraints satisfied, the test proceeded through the rescheduled design limit and mission simulation test points until a breakthrough was observed at 0040 of day 124. This condition was caused by the inlet temperature to the sublimator exceeding 70⁰F. This occurred during a switchover of valves from the HSD two-position valve to the ATM valve which had been used in the FE test. This was necessary due to the HSD valve exhibiting cycling behavior about the 70⁰F set point.

Sublimator operation was reestablished by again breaking the external water line and allowing air to blow into the chamber through the sublimator. Operation was resumed at 0320 and test points 34, 35, and 36 were completed.

The nozzle heaters were turned off at 0458, and flow was routed away from the duct at 0600. The test was completed at 1005 on day 124.

During the latter part of the test, the set point changes were controlled manually, due to the use of the ATM valve in place of the HSD valve. Due to the delays encountered by facility failures, the sublimator test was reconfigured to address the most important objectives--that

of system operation. Component data was deferred to a later test. It was felt that the revised timeline adequately tested the integrated radiator/sublimator system in limiting cases.

5.0 TEST RESULTS AND DISCUSSION

This section analyzes the test data in terms of the key objectives of the test program. For purposes of discussion, these results are grouped to include (1) modular radiator performance, (2) evaporator performance and response (including nozzle heating tests), (3) sublimator performance and response (including nozzle heating tests), and (4) system-wide aspects of performance, including interaction between the MRS, the cooling device, and the water management system.

5.1 MRS Performance

The MRS performance is evaluated by observation of the following parameters: (1) steady state heat rejection and (2) rapid response to change in outlet temperature set point. Both of these attributes were demonstrated in the MRS testing, and were reverified in these tests.

Figure 13 displays total, bank and prime flow rates during the radiator/evaporator testing, as they adjust to different set point requirements, radiant environments, and inlet temperatures. Figures 14 and 15 show radiator inlet and outlet temperatures during the flash evaporator operation.

Table 4 is a display of heat rejection by the radiator main and bank circuits for each test point. The total radiator heat rejection can be seen to be adjustable between essentially zero and 67,000 BTU/hr for total Freon flow rates of 2200 lb/hr. The ability of the MRS to reject typical shuttle heat loads was demonstrated again as it had been in previous testing.

TABLE 4
CALCULATED HEAT REJECTION

| TEST POINT | HEAT REJECTION (BTU/hr) | | | |
|------------|-------------------------|------------------------|---------------------------|--------|
| | RADIATOR PRIME TUBES | RADIATOR BANK TUBES | EVAPORATOR/ SUBLIMATOR | TOTAL |
| 1 | 1,022 | 50,330 | 14,630 | 65,982 |
| 2 | 229 | 52,600 | 14,680 | 67,509 |
| 3 | 49 | 48,620 | 14,400 | 63,069 |
| 4 | 111 | 32,570 | 9,817 | 42,498 |
| 5 | -42 | 13,950 | 163 | 14,111 |
| 6 | -20 | 9,005 | - 324 | 8,650 |
| 7 | 746 | 13,470 | 594 | 23,813 |
| 8 | 690 | 13,310 | 2468 | 16,468 |
| 9 | 1,073 | 4,033 | 4,961 | 10,067 |
| 10 | 1,284 | 3,103 | 14,320 | 18,707 |
| 11 | 1,011 | 26,850 | 719 | 28,580 |
| 12 | 420 | 41,110 | 6,539 | 48,069 |
| 13 | 1,145 | 48,380 | 15,260 | 64,785 |
| 14 | -1,232 | 681 | 6,410 | 5,859 |
| 15 | 207 | 40,810 | 12,470 | 60,578 |
| 16 | 913 | 33,710 | 5,238 | 39,861 |
| 17 | 212 | 29,890 | 6,210 | 36,312 |
| 18 | 61 | 40,090 | 6,494 | 46,645 |
| 19 | 564 | 28,310 | 4,743 | 33,617 |
| 20 | -15 | 48,710 | 7,577 | 56,272 |
| 21 | 418 | 44,620 | 15,150 | 60,188 |

TABLE 4(cont.)

CALCULATED HEAT REJECTION

| TEST POINT | HEAT REJECTION (BTU/hr) | | | |
|------------|-------------------------|------------------------|---------------------------|--------|
| | RADIATOR PRIME TUBES | RADIATOR BANK TUBES | EVAPORATOR/ SUBLIMATOR | TOTAL |
| 22 | 1,579 | 29,910 | 14,120 | 45,609 |
| 23 | - 71 | 15,980 | 15,110 | 31,019 |
| 24 | 306 | 28,770 | 15,640 | 44,716 |
| 25 | - 189 | 31,070 | 11,820 | 42,701 |
| 26 | - 260 | 16,310 | 6,931 | 22,981 |
| 27 | 1,494 | | 17,840 | |
| 28 | 5,903 | 27,030 | 9,313 | 42,246 |
| 29 | 553 | 39,690 | 10,640 | 50,883 |
| 30 | 210 | 37,460 | 12,660 | 50,330 |
| 31 | 1,461 | 66,080 | 10,160 | 77,701 |
| 32 | | | | |
| 33 | | | | |
| 34 | 545 | 23,910 | 14,190 | 38,645 |
| 35 | 988 | 41,490 | 15,430 | 57,908 |
| 36 | | | | |

The quick response to set point changes can be seen in Figure 16 for several test points. No more than a three minute delay was observed between a set point change and the establishment of the desired outlet temperature.

5.2 Evaporator Performance

The performance of the FE is shown in Figures 17 through 26. Figure 17 shows the inlet temperature to the evaporator (downstream of the duct) and the outlet temperature. The device is designed to provide outlet temperatures in the range of $40^{\circ}\text{F} \pm 2^{\circ}\text{F}$ for all inlet temperatures between 40°F and 70°F . Figure 18 is a plot of the ΔT across the FE, and Figure 19 is the ΔT across both FE and duct. It can be seen that the thermal mass of the ducting causes a negative temperature differential during the rapid cyclic variation of test point 8. The calculated heat rejection across the FE is shown in Figures 20 and 21, and is tabulated in Table 4 at times representing the end of each test point.

Figures 22 through 24 are expanded-scale plots of inlet and outlet temperatures during key design limit test points: (1) rapid heat load change, (2) steady high heat loads, and (3) steady low loads. In each case, the evaporator was able to respond with a controlled outlet temperature.

In Figure 25, the inlet temperature and outlet temperature are plotted against each other for many different test points. The expected performance band is shown. The upward shift of this band when the inlet reaches 70°F is due to the design of this particular FE. At this

inlet temperature, the evaporant valve is continuously spraying at 16 lb/hr, its designed maximum flow. A further load increase thus cannot be matched by an increased water flow, and the outlet temperature begins to climb above 40°F.

Estimates of flash evaporator efficiency were made throughout the test by comparing the rejected heat to the amount of water consumed. The parameter h_{fg} represents the ratio of these two quantities, and for perfect efficiency would equal the latent heat of vaporization of water. Typical average h_{fg} values are shown below, for one-hour periods of relatively stable test conditions:

| From | To | Rejected Heat(BTU) | Change in Tank Level(lb) | Fuel Cell H_2O (lb) | Calc. Usage(lb) | h_{fg} (BTU/lb) |
|----------|------|--------------------|--------------------------|-----------------------|-----------------|-------------------|
| 121/2030 | 2130 | 5020 | 3.2 | 8.0 | 4.8 | 1045.8 |
| 122/0300 | 0400 | 5350 | 1.5 | 7.0 | 5.5 | 972.7 |
| 0700 | 0800 | 15,477 | -2.4 | 12.1 | 14.5 | 1067.4 |

The FE was shown to be operating with its normal efficiency for the majority of the test.

Figure 26 is a composite plot of pressure and temperature data taken during the nozzle and duct heating test. The falling nozzle throat and duct temperature was observed for approximately $2\frac{1}{2}$ hours following the turning off of the duct heater. As the duct became ice-clogged, the chamber pressure began a rapid rise until the duct completely froze, a condition that was observed by the duct temperatures starting upwards again. When the Freon was routed back to the duct, the frozen condition was alleviated and a restart of the flash evaporator was accomplished.

5.3 Sublimator Performance

The facility problems encountered during the sublimator portion of the integrated test caused substantial reduction in the time available for sublimator testing. Furthermore, even during the reduced time available, many test profile changes were made on a realtime basis to maintain sublimator operation. Thus, component data taken was not as complete as that taken on the MRS/flash evaporator system. However previous experience with sublimators is extensive, due to their use in the Apollo LM and PLSS programs, making component performance data less important.

Figure 27 displays sublimator inlet and outlet temperatures. The many inlet temperature spikes which can be seen are real time manual increases which were needed to restore sublimator water flow and prevent further test delays. The sublimator is subject to flow stoppage if the heat load imposed is not kept above a certain minimum level. This minimum level may be related to temperature of the feedwater, which was subject to periodic freezing in the unheated section of the line. The uncertainty associated with the low load operation of the sublimator indicates the need to properly allow a safety margin in the design of the sublimator.

The excursions in the outlet temperature profile shown in Figure 27 are representative of a breakthrough phenomenon and demonstrate a sensitivity to higher-than-spec heat loads. Again, proper margin should be considered to prevent the necessity of completely drying out the sublimator and reforming the ice layer following a breakthrough.

In Figure 28, an operational curve for the sublimator demonstrates

that the device performed within acceptable limits except during feed-water flow stoppage. Figure 29 is a display of heat rejection calculated for the MRS and sublimator at various times during the testing. These values are tabulated in Table 4.

Although limited data was obtained, the sublimator operated to maintain a predictable, steady outlet temperature when provided a cyclic inlet temperature so long as the design limits for the device were not exceeded.

5.4 System Performance

The performance of the integrated systems has two aspects: (1) the adequacy of water level control system to prevent overfilling or depletion of the water tank, and (2) the sensitivity of the MRS/expendable cooling device to changes in set point. The latter performance criterion should demonstrate that total heat rejection is acceptable even though the "allocation" of this rejection may change rapidly. These two aspects of system performance will be discussed separately.

The water supply to the storage tank is displayed in Figures 30 and 31 for FE and sublimator. This flow rate was keyed to the heat load during the mission profile test points. Figure 32 shows the water level in the tank during a high load, high flow test point. Tank level control was maintained in all situations; the maximum tank quantity that was observed during the test was 98 lb.

During the design limit cases, worst case conditions were set up in an attempt to overfill the tank. The system was allowed to drop to a cold-soaked condition by running for several hours at a low inlet

temperature. Then the tank was manually filled to 94.7 lbs, or just below the point at which a 70°F set point switch would occur. At this point a high heat load was applied, but a lag was assumed to exist between the high water flow rate and the increase in radiator inlet temperature. Thus the tank began filling at a rapid rate, the set point was changed to 70°F, but due to the inlet temperature to the radiators coming up slowly (10°F/hr) from 50°F, the evaporator could not operate to remove tanked water.

Figures 33 and 34 show that tank quantity peaked at approximately 98 lbs before the radiator outlet temperature got high enough to require water feed to the cooling device.

Another key test objective was to observe system performance under cyclic conditions. These conditions were generated in two ways. In the design limit runs, the water flow to the tank and the heat load were set into continual cycling. That is, at a 50°F set point the tank would be depleted below 85lb, at which time a 40°F set point would cause filling again to raise the tank level above 85lb. The resulting valve swings occurred approximately every 11 minutes, and as can be seen from Figure 35, resulted in no loss of control for the cooling device.

In a related mission simulation, the cycling environment caused inlet temperatures to the **expendable** cooling device to cycle. This was due to the inability of the radiator to maintain 40°F set point for a 150BTU/hrft² imposed environment. Again, the device was able to maintain a constant outlet temperature despite the variation in inlet temperature.

6.0 CONCLUSIONS

The integrated concept was tested and generally verified over a wide range of conditions. Although the test was subject to many problematical situations, none was related to a failure related to the system aspect, i.e., the temperature control system or the water level indicators. (One possible exception to the above statement is the malfunctioning of the HSD mixing valve, but this problem was in reality a component failure and unrelated to the integrated concept.) The water tank level was maintained within acceptable limits, and heat rejection was in the amounts desired and predicted.

The systems response to rapid changes in heat load, and to mission-type cyclic heat load was stable, with evaporator and sublimator maintaining desired outlet temperature within adequate limits.

The testing to determine necessity of duct and nozzle heaters resulted in a conclusion that the nozzle heater is not required, but the duct heater is required to prevent ice buildup if the flash evaporator is used. The sublimator duct, being larger than that of the FE, probably would not require heat, although this was not verified during the present testing.

Comparative data for FE and sublimator was acquired on a component level, although the system performance of the sublimator was confused due to facility problems. Further testing is indicated.

FIGURE 1: RESULTS OF WEIGHT-OPTIMIZATION OF SHUTTLE ATCS

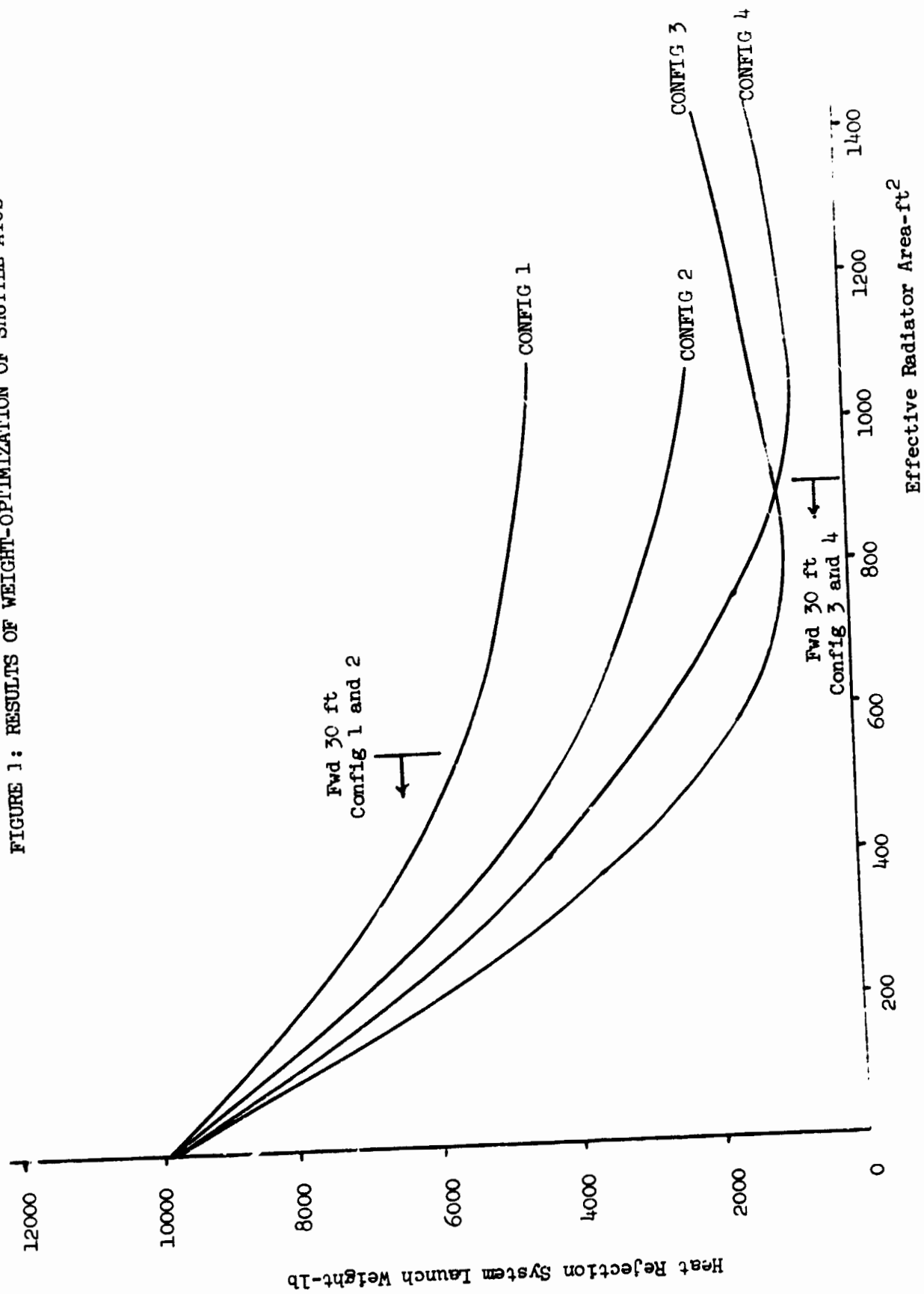


FIGURE 2: SHUTTLE RADIATOR CONFIGURATIONS

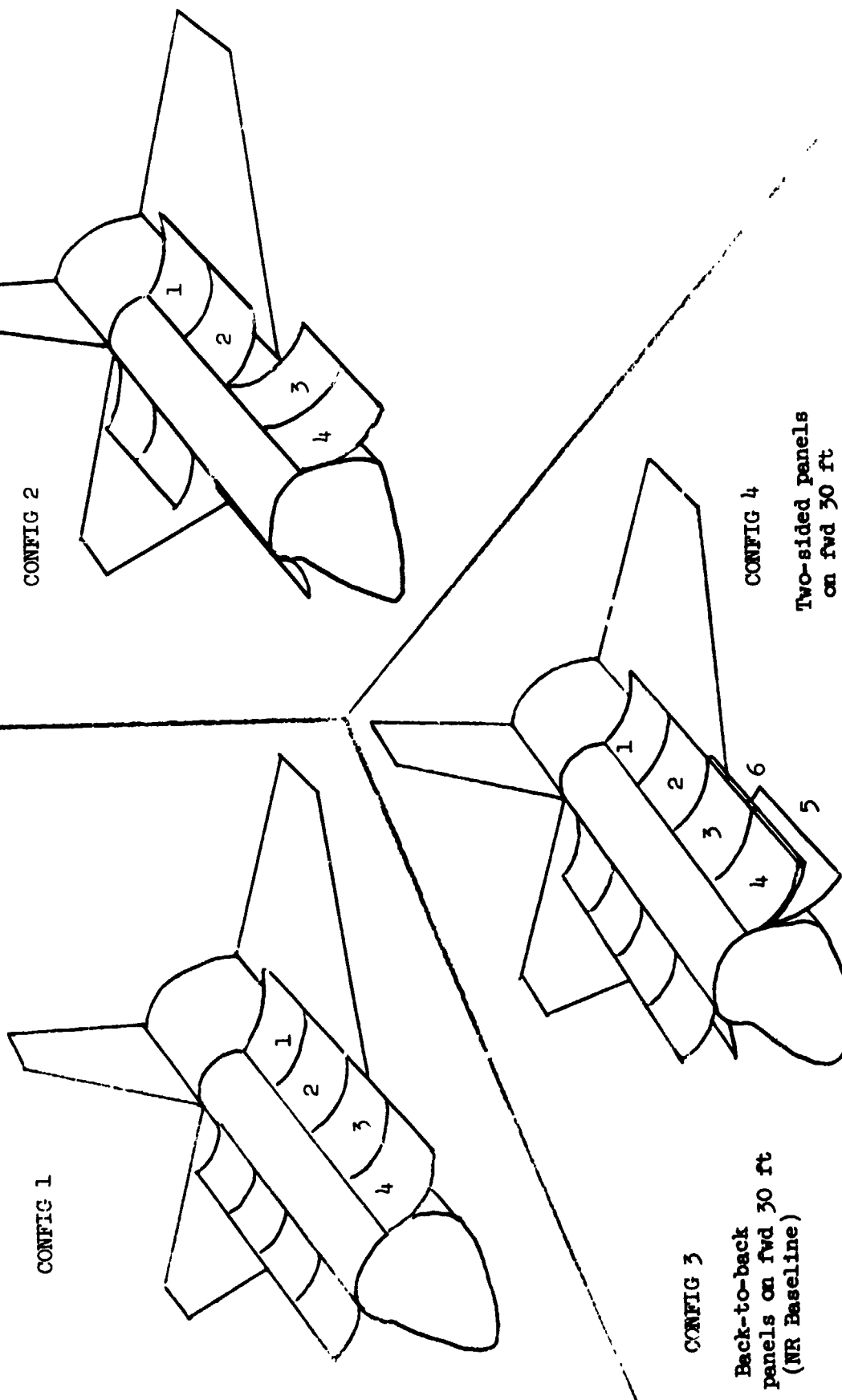


FIGURE 3: SIMULATION OF RADIATOR CONFIGURATION 4 BY TEST ARTICLE

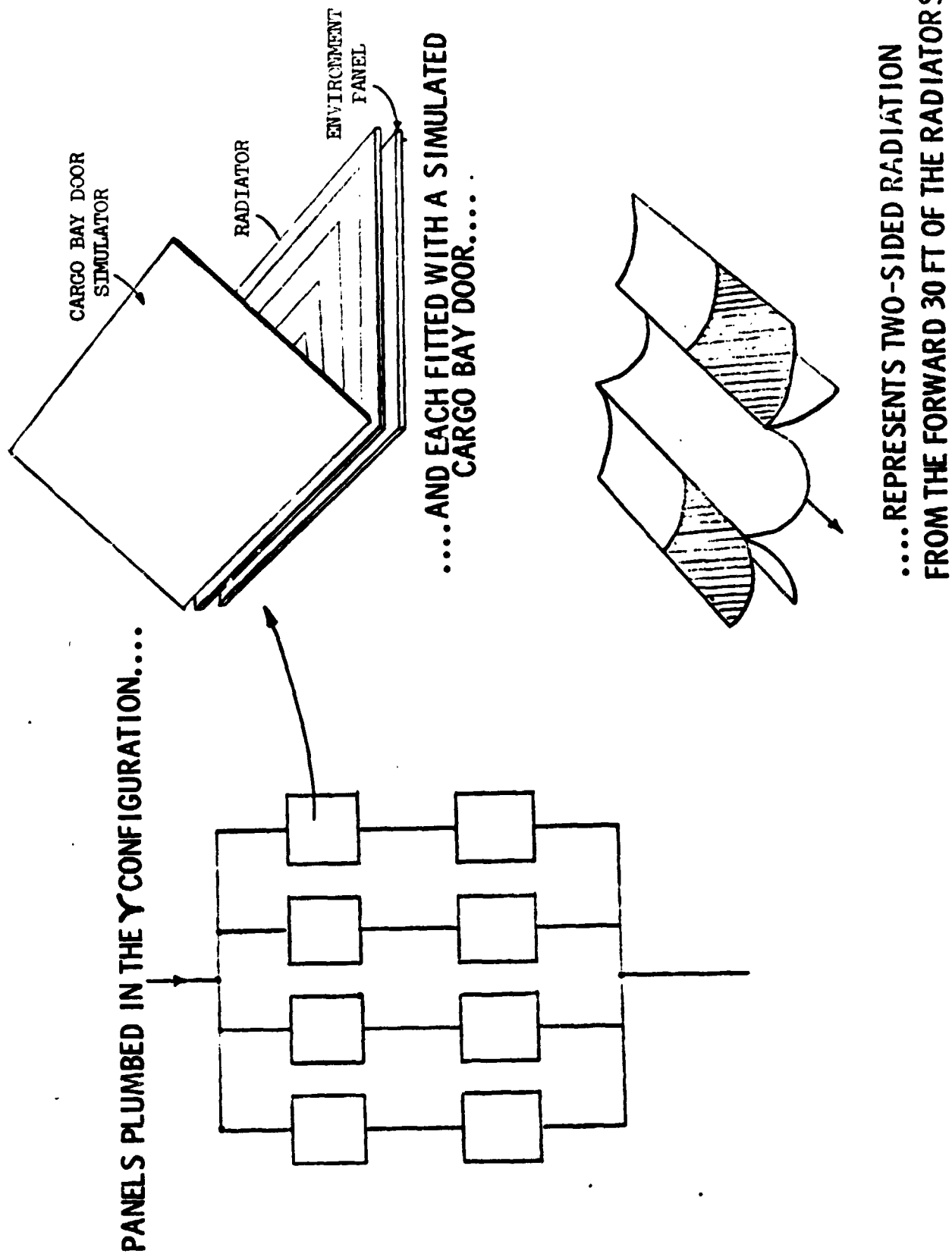
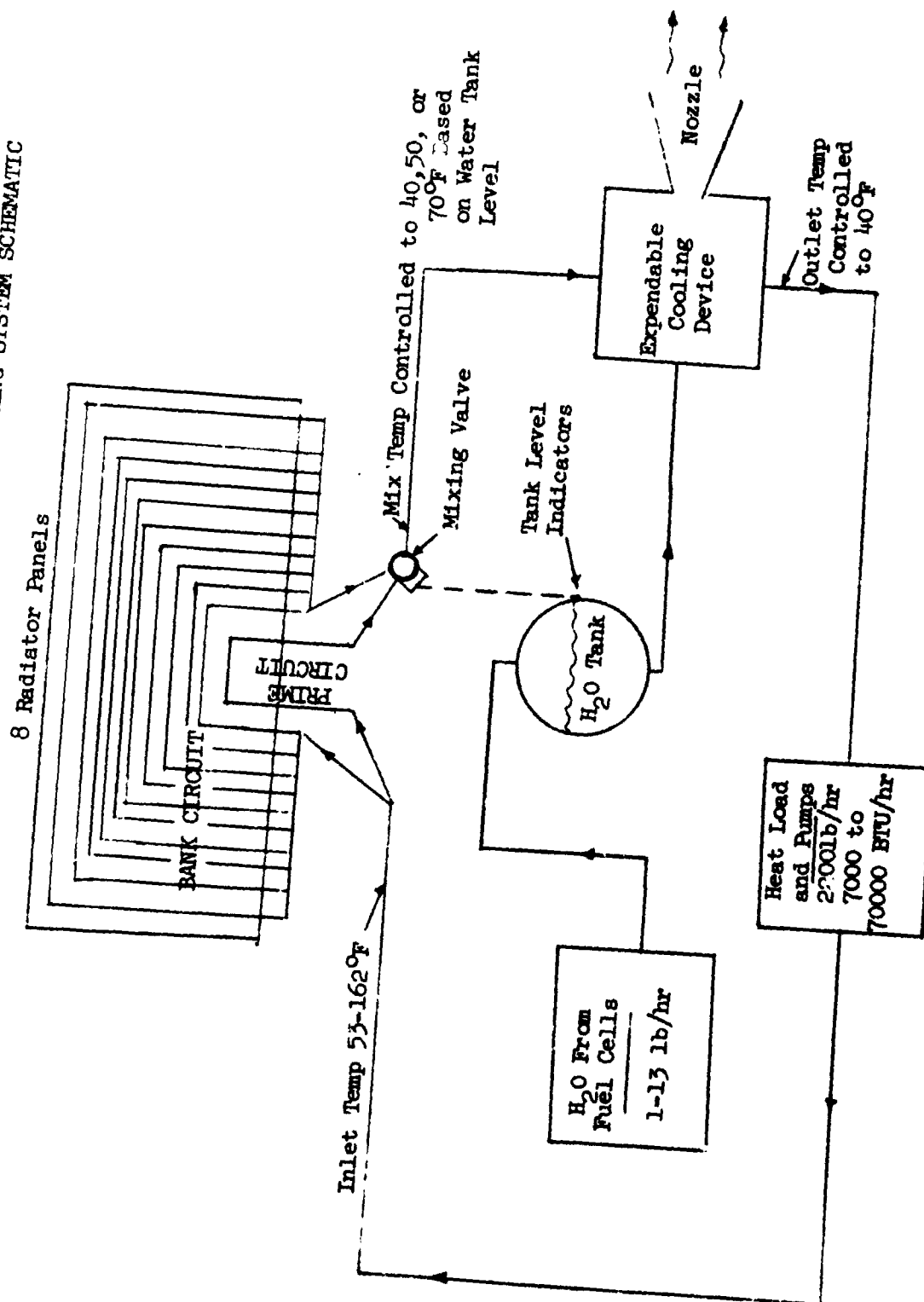


FIGURE 4: INTEGRATED RADIATOR/EXPENDABLE COOLING SYSTEM SCHEMATIC



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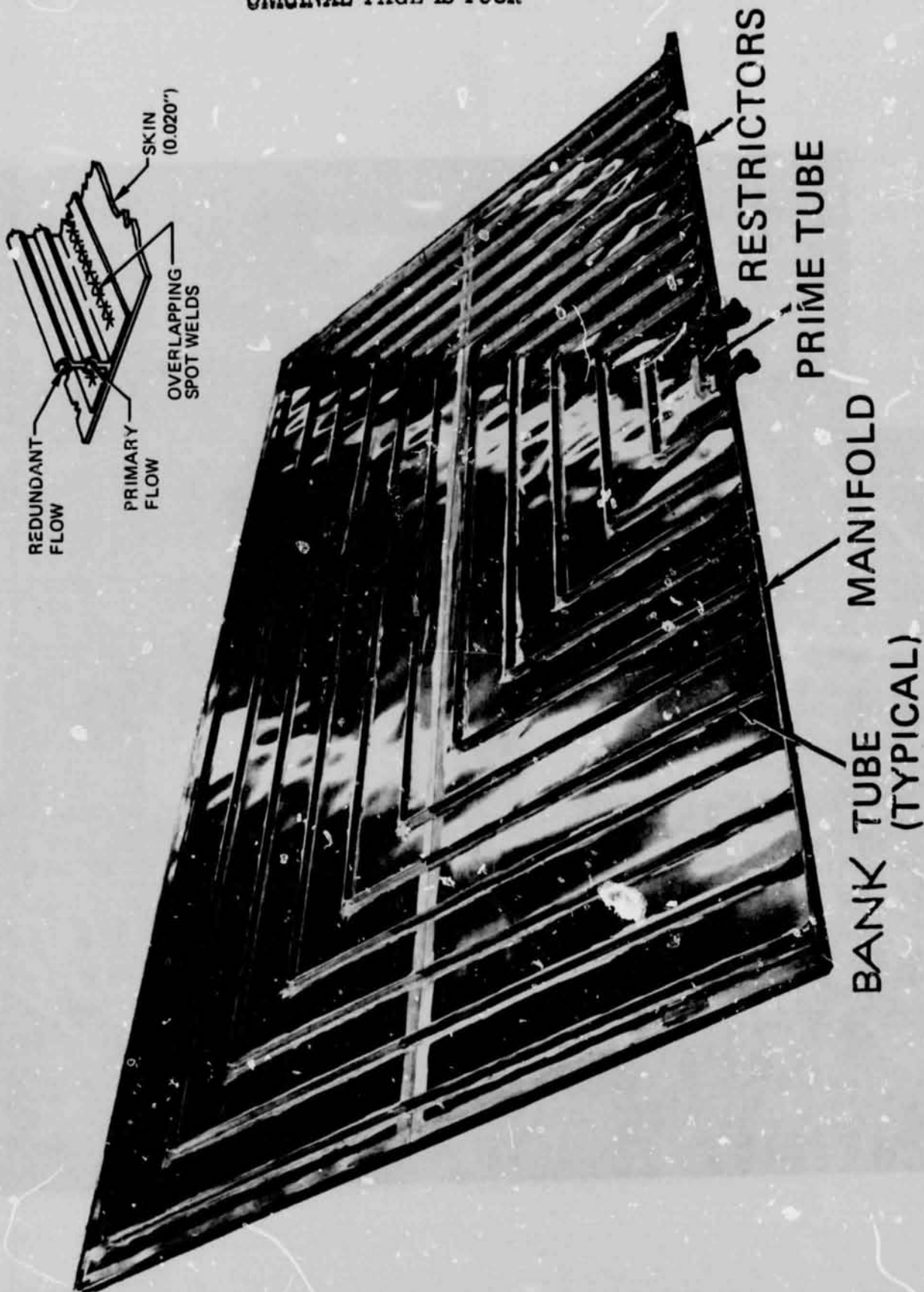
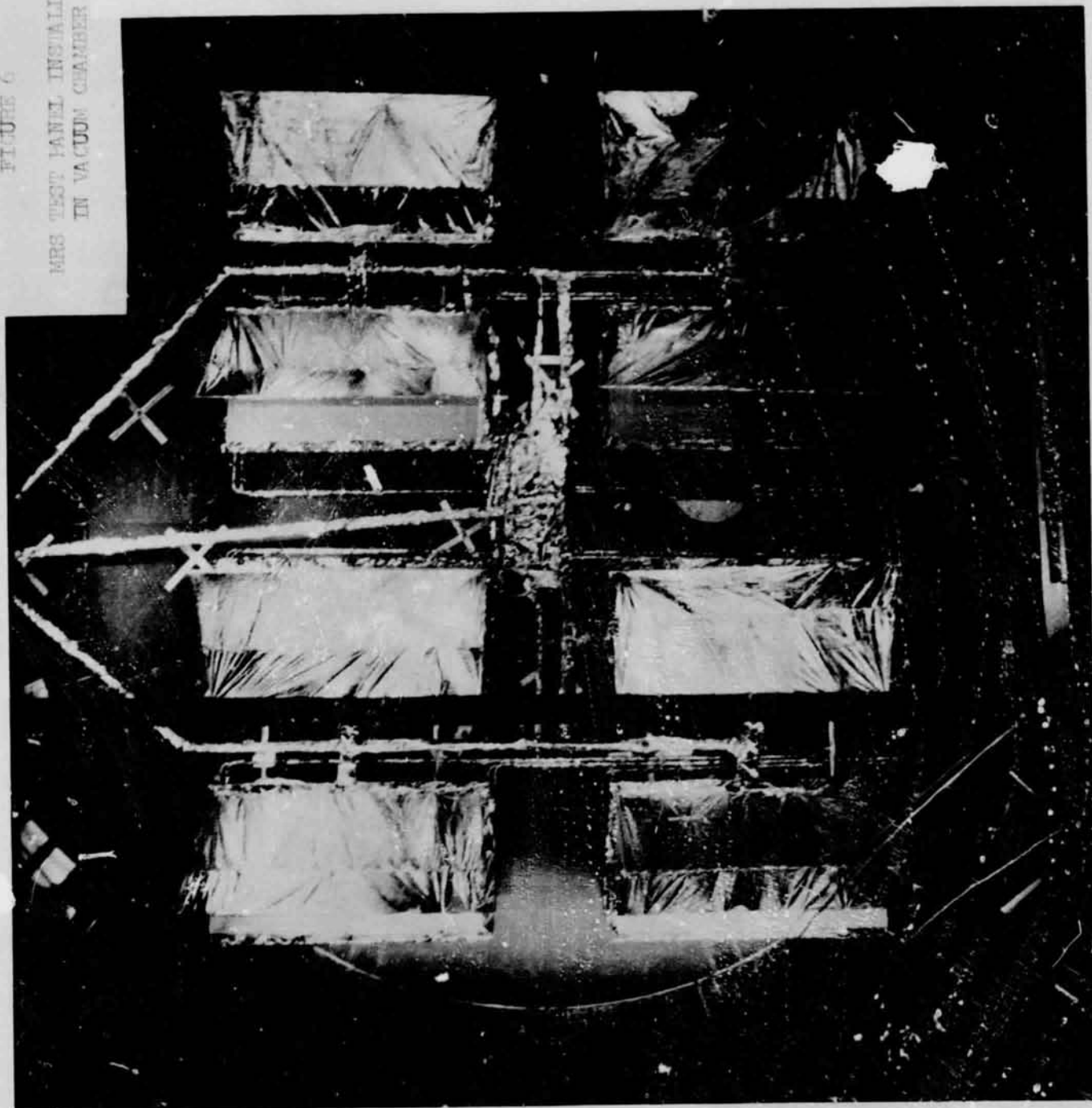


FIGURE 5

UNCOATED RADIATOR PANEL

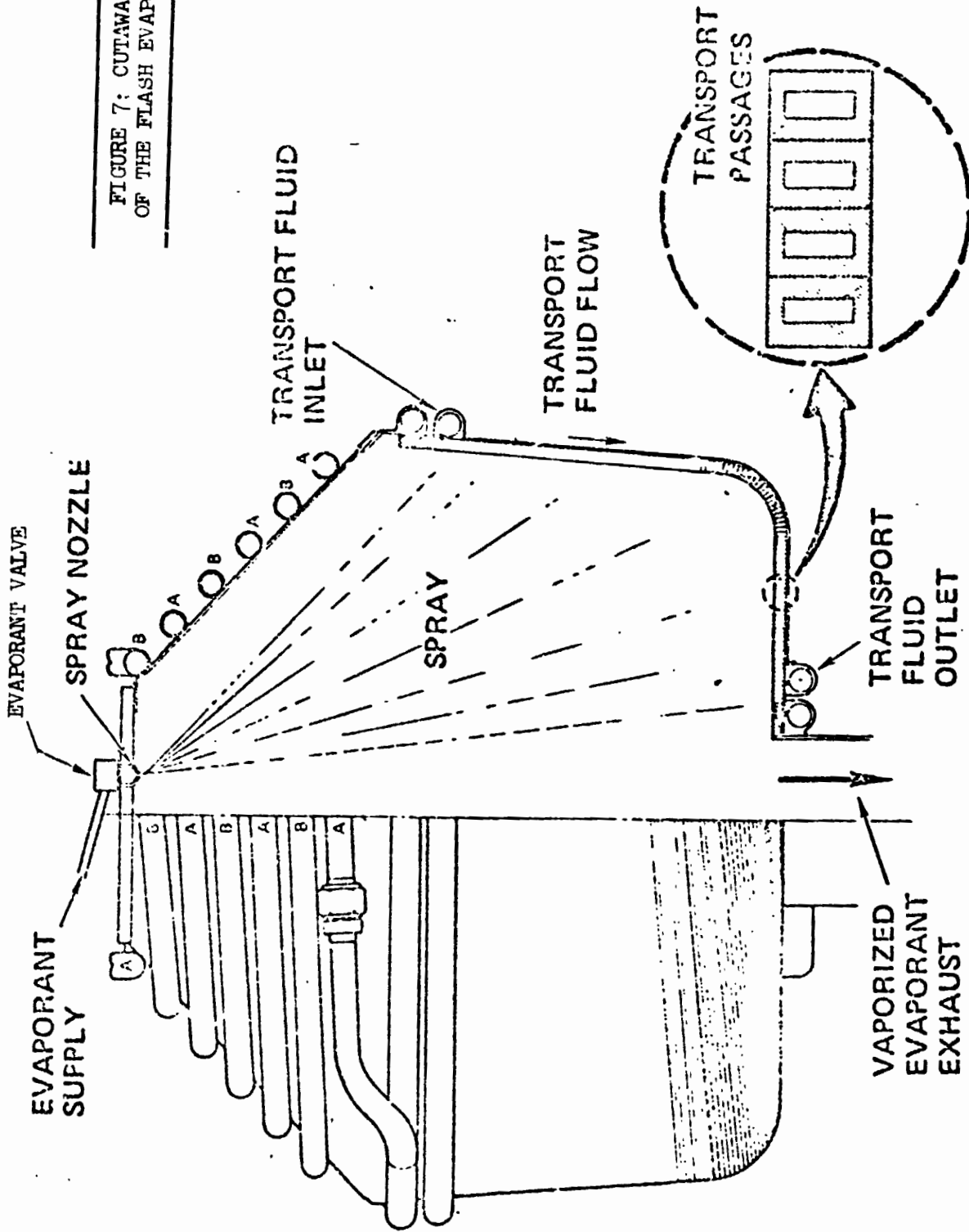
FIGURE 6

MRS TEST PANEL INSTALLATION
IN VACUUM CHAMBER



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FIGURE 7: CUTAWAY DRAWING
OF THE FLASH EVAPORATOR



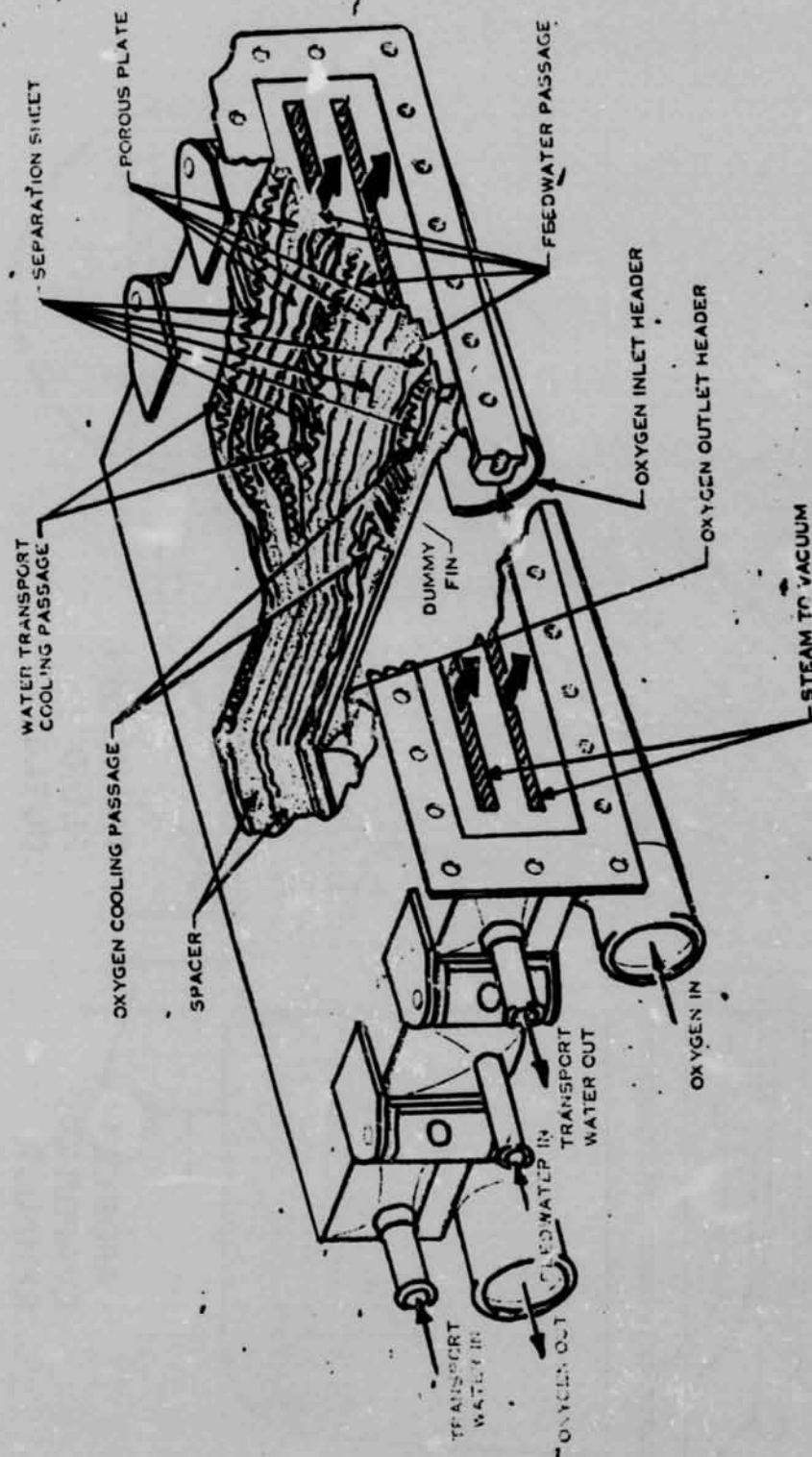


Figure 8
CUTAWAY DRAWING OF THE SUBLIMATOR

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FIGURE 9: DUCT AND NOZZLE DIMENSIONS

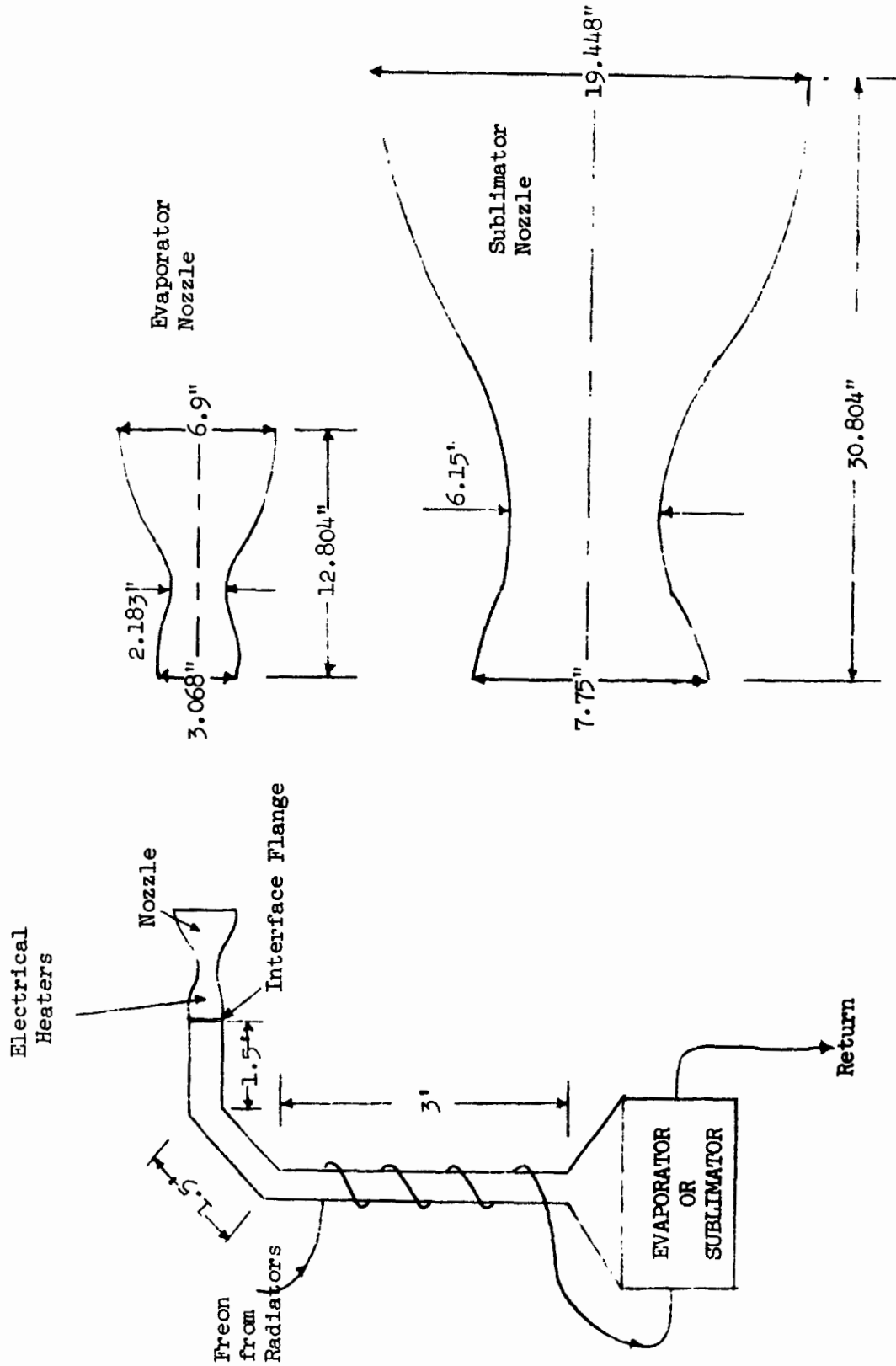


Figure 10

SUPERSONIC NOZZLES PRIOR TO
INSTALLATION IN THE CHAMBER

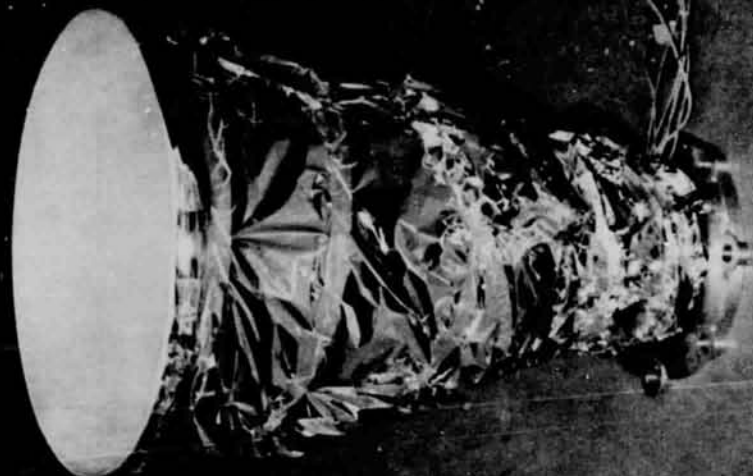


FIGURE 11 : CONTROL SYSTEM
CHARACTERISTICS

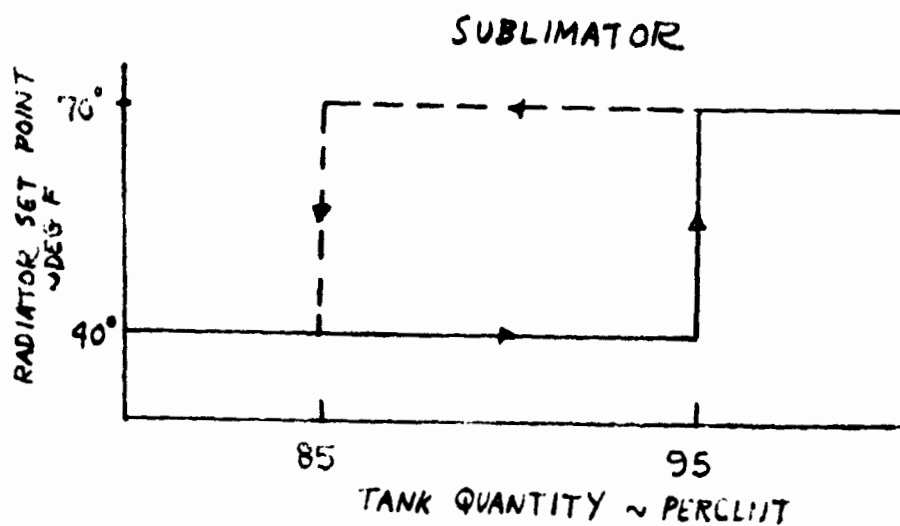
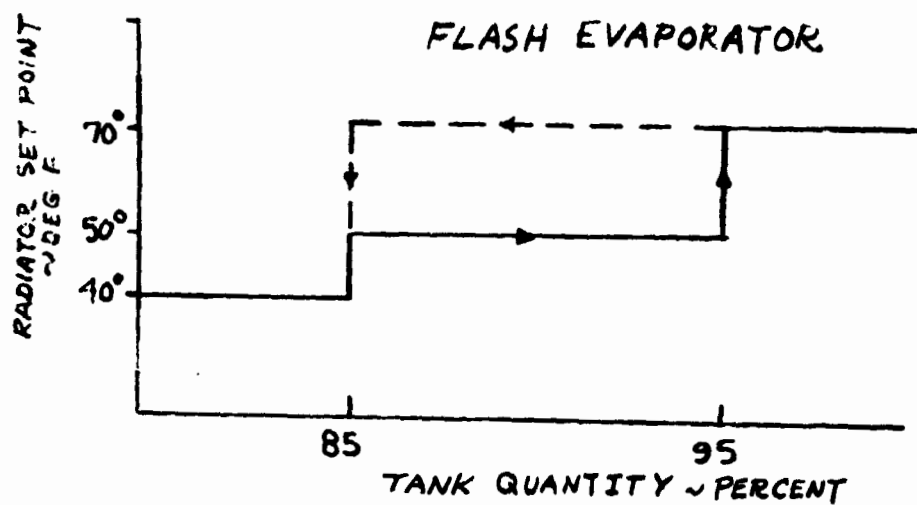


FIGURE 12



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FIGURE 13: RADIATOR TOTAL, BANK, AND PRIME FLOW RATES

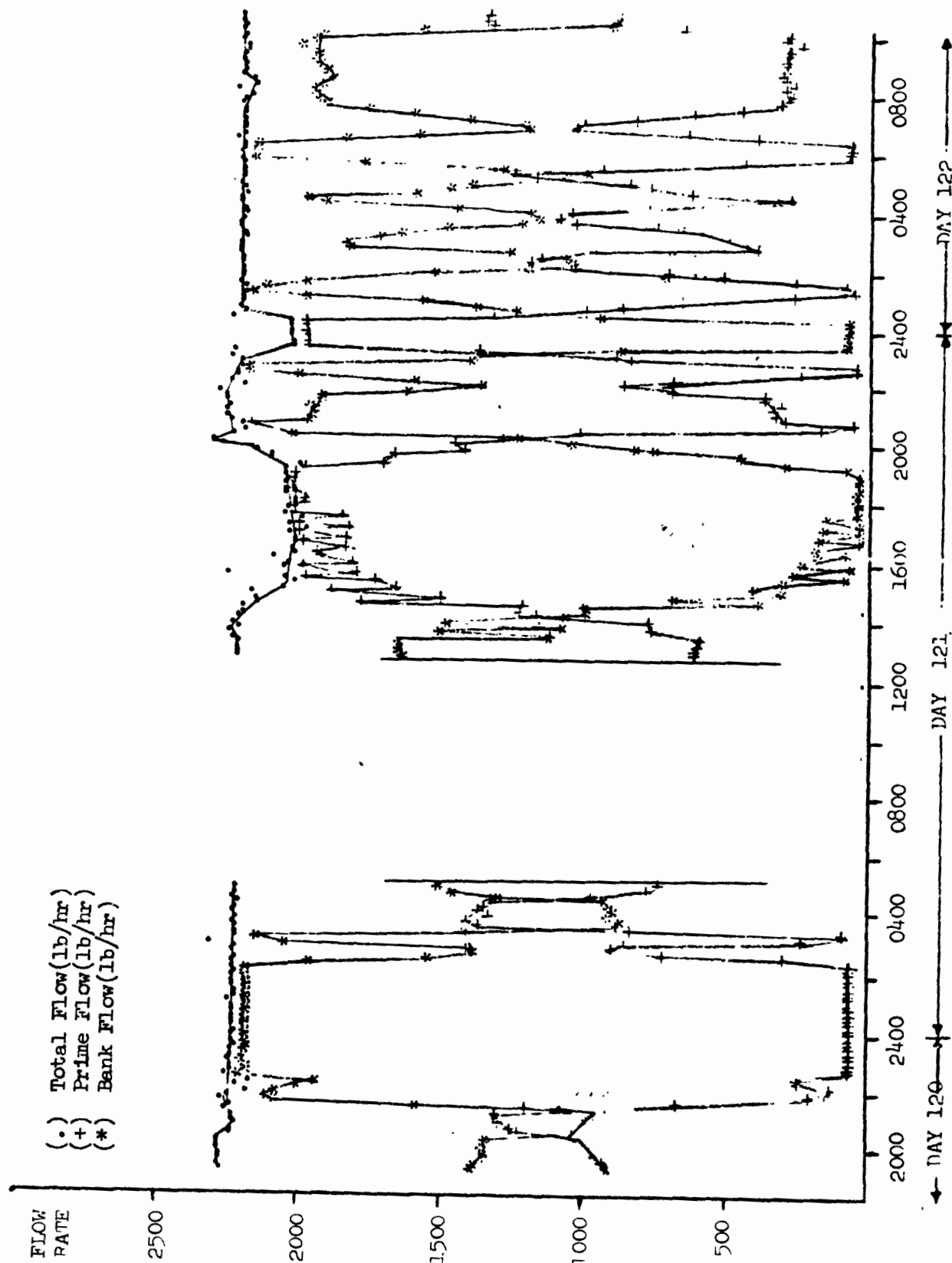


FIGURE 14: PRIME AND BANK INLET AND OUTLET TEMPS

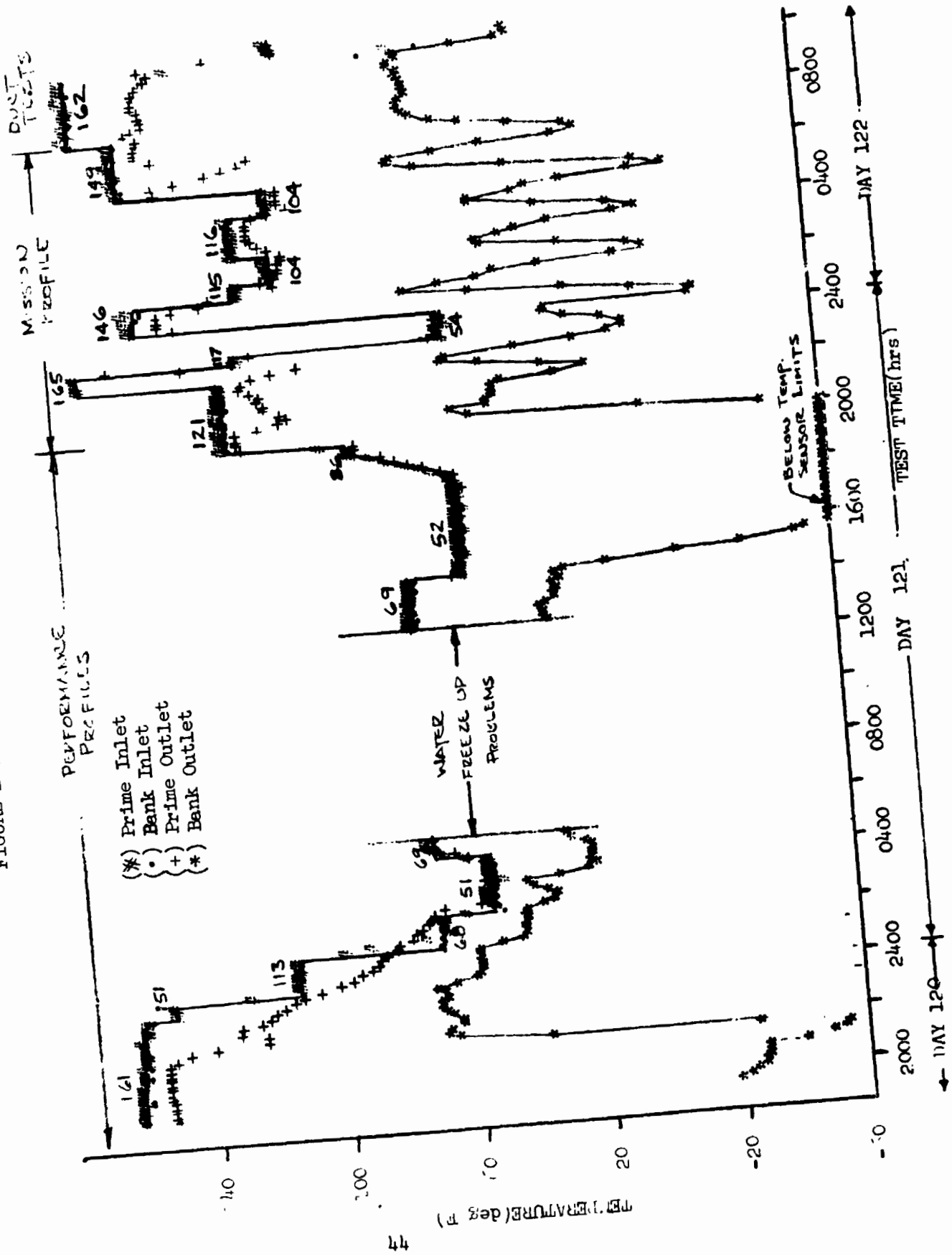


FIGURE 15: RADIATOR MIXED OUTLET AND EVAPORATOR INLET TEMPS

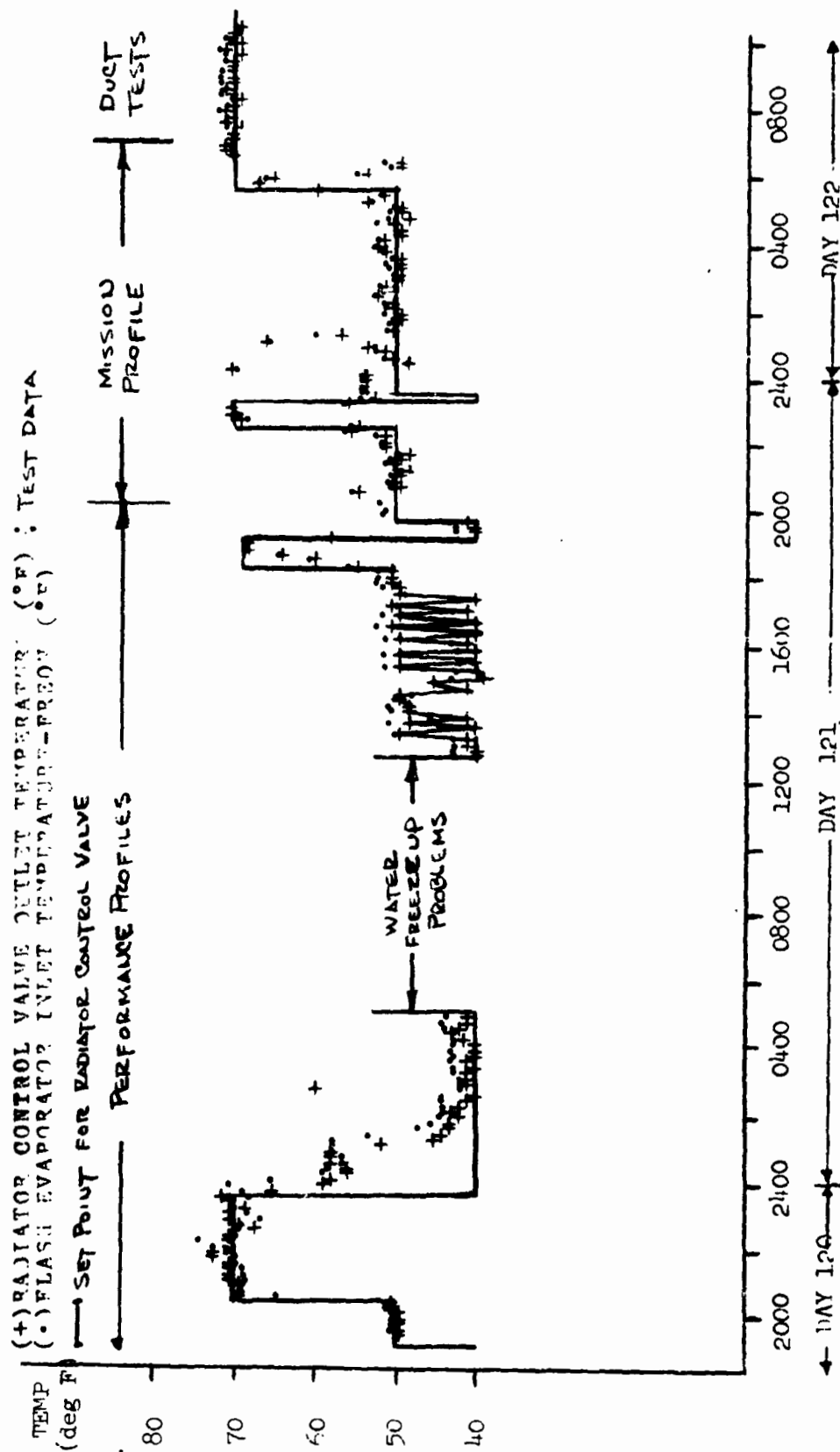


FIGURE 16: MIXED OUTLET TEMP RESPONSE DURING SET POINT CHANGES

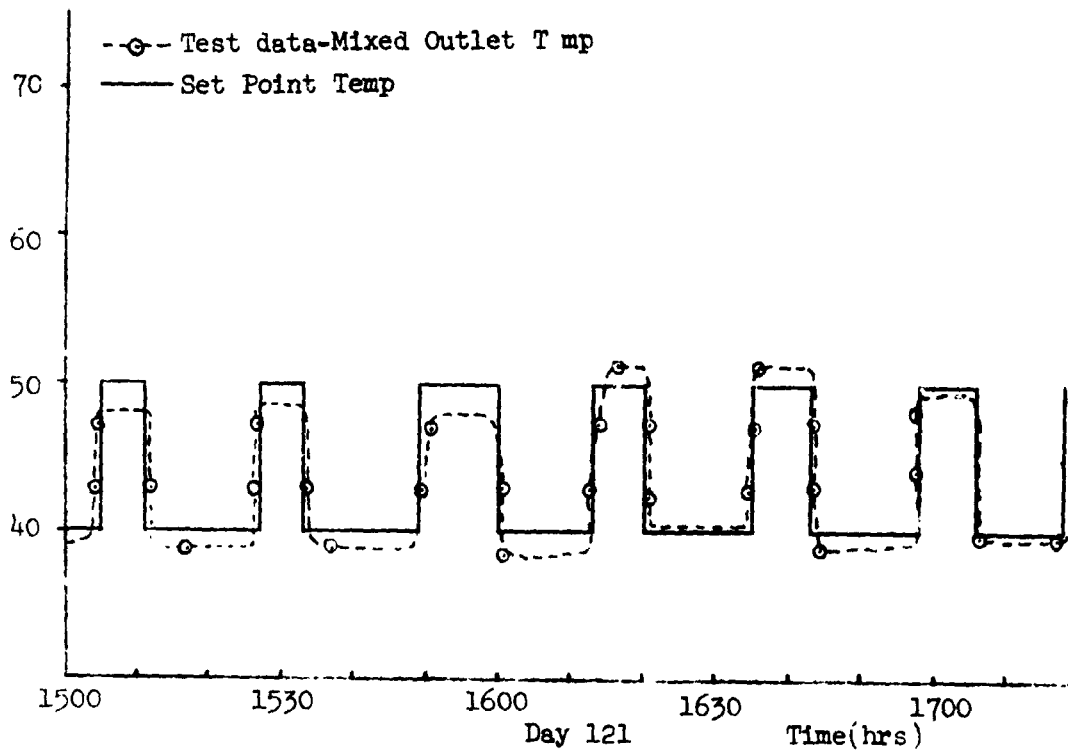
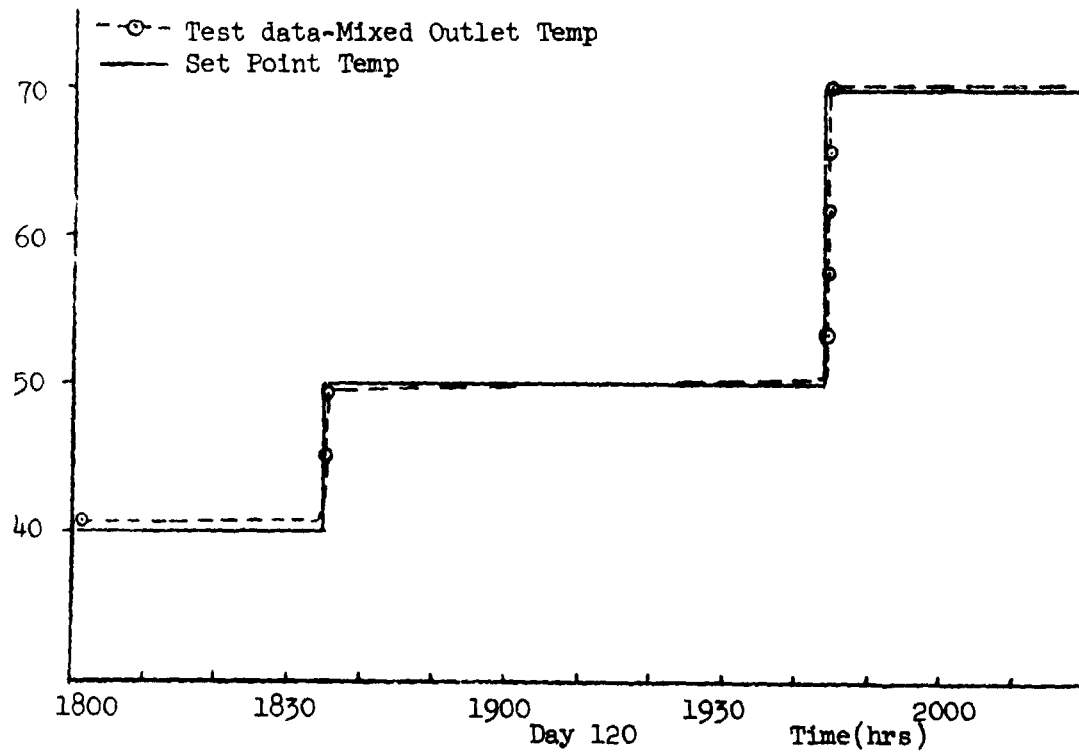


FIGURE 17: FLASH EVAPORATOR INLET AND OUTLET FREON TEMPERATURES

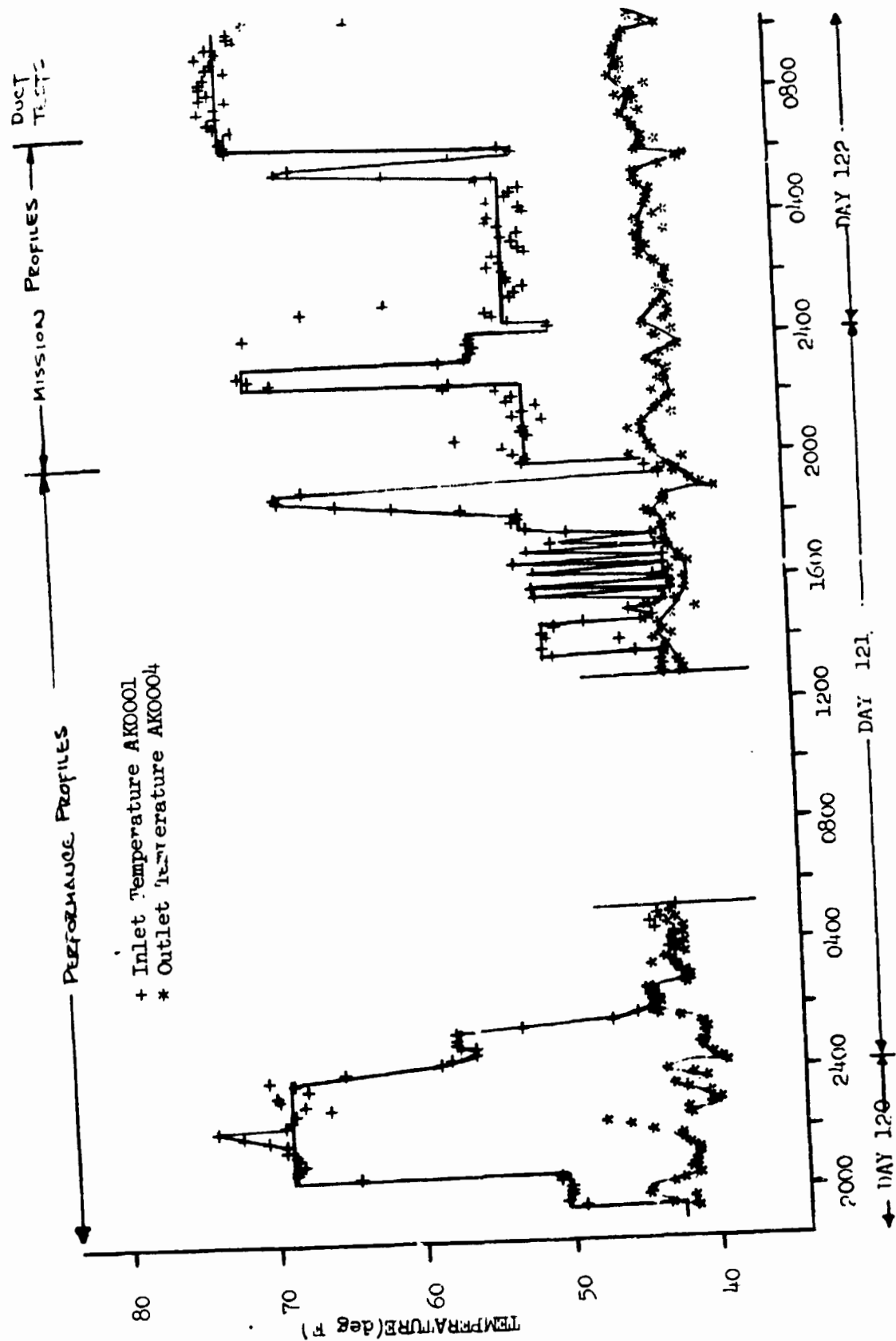


FIGURE 18:

FLASH EVAPORATOR FREON TEMPERATURE
DIFFERENTIAL ACROSS EVAPORATOR (°F)
A10001-AE0014

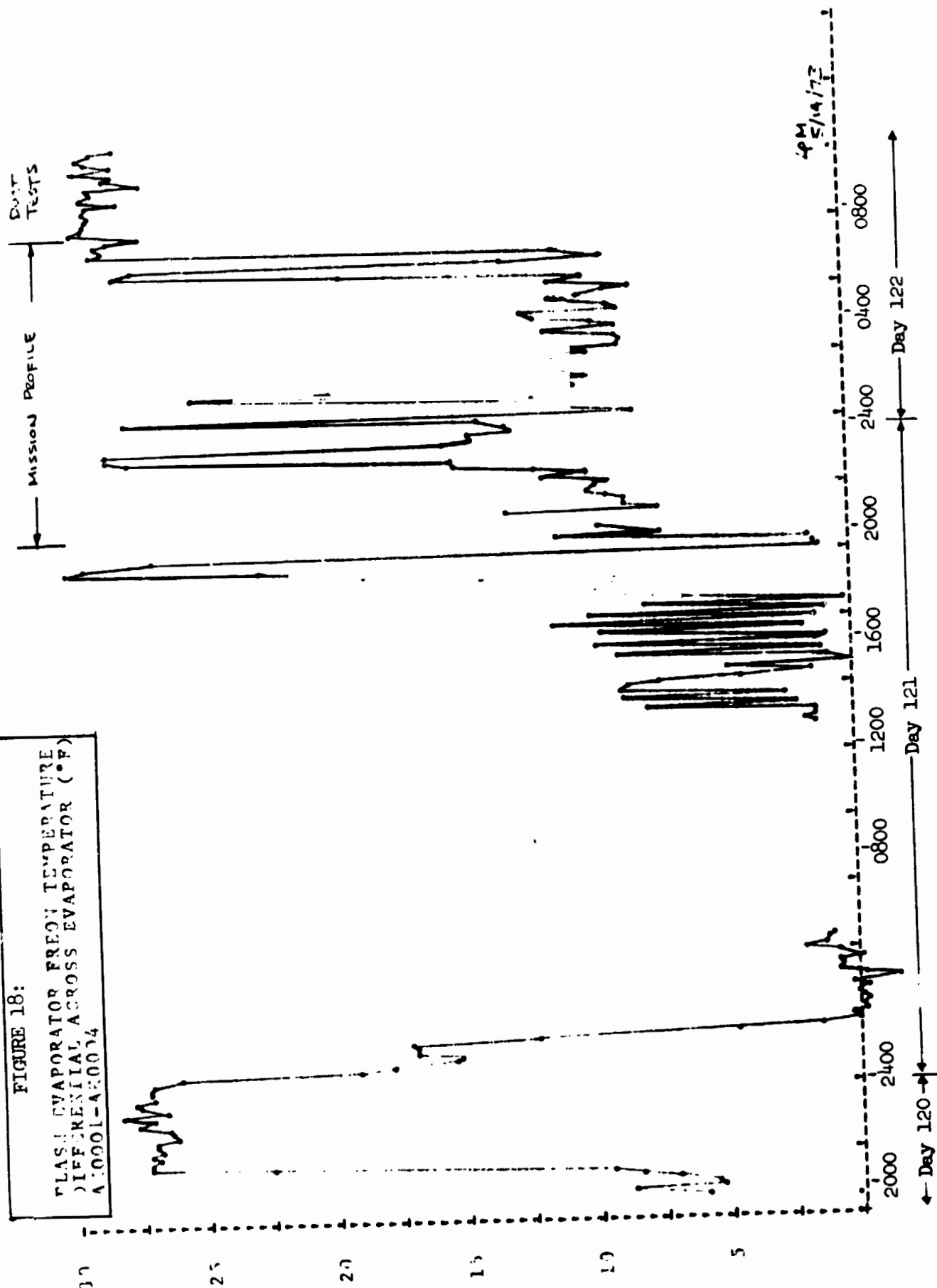


FIGURE 19: TEMPERATURE DIFFERENTIAL ACROSS DUCT AND FLASH EVAPORATOR

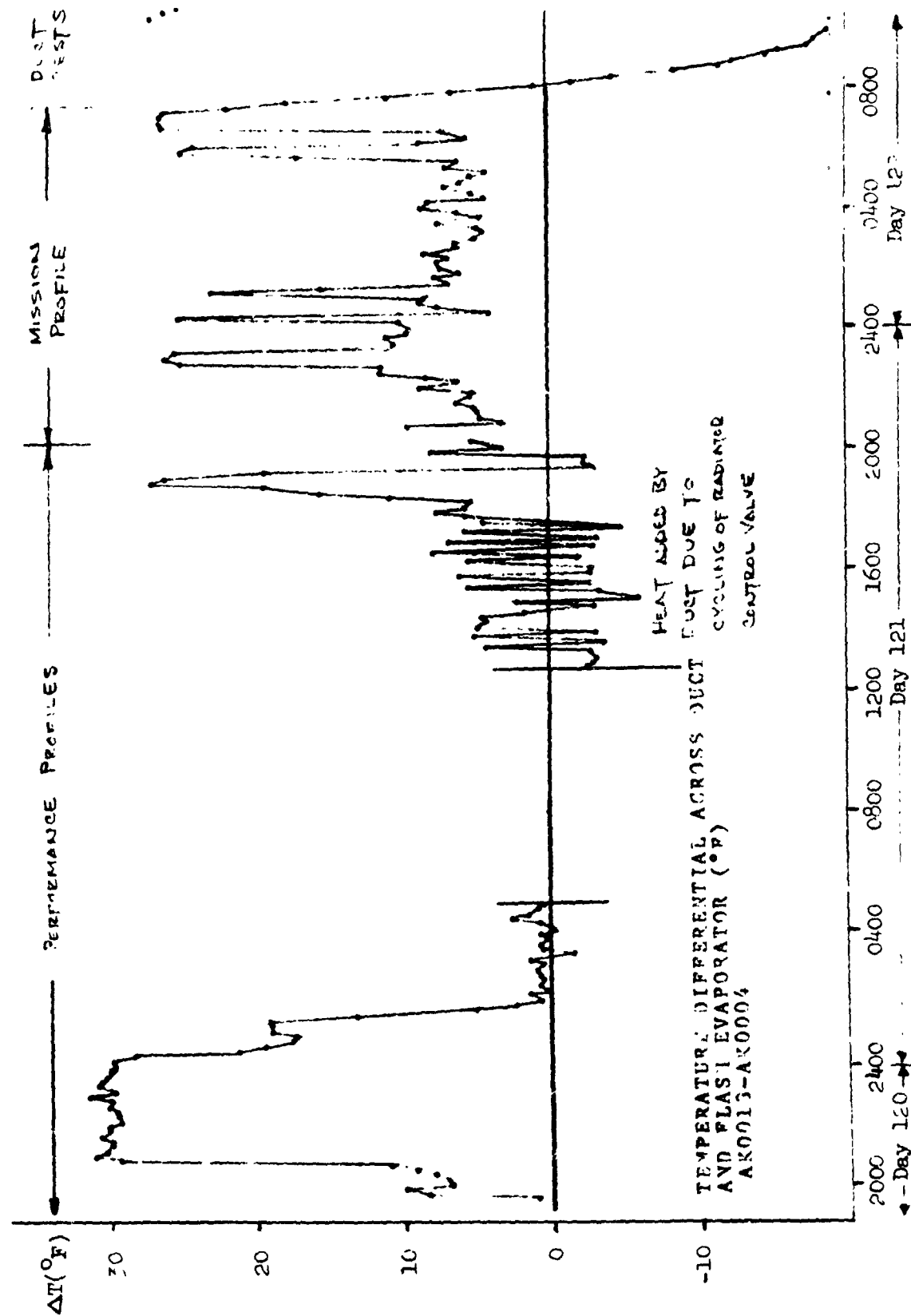


FIGURE 20:
CALCULATED HEAT REJECTION FOR RADIATORS AND
FLASH EVAPORATOR

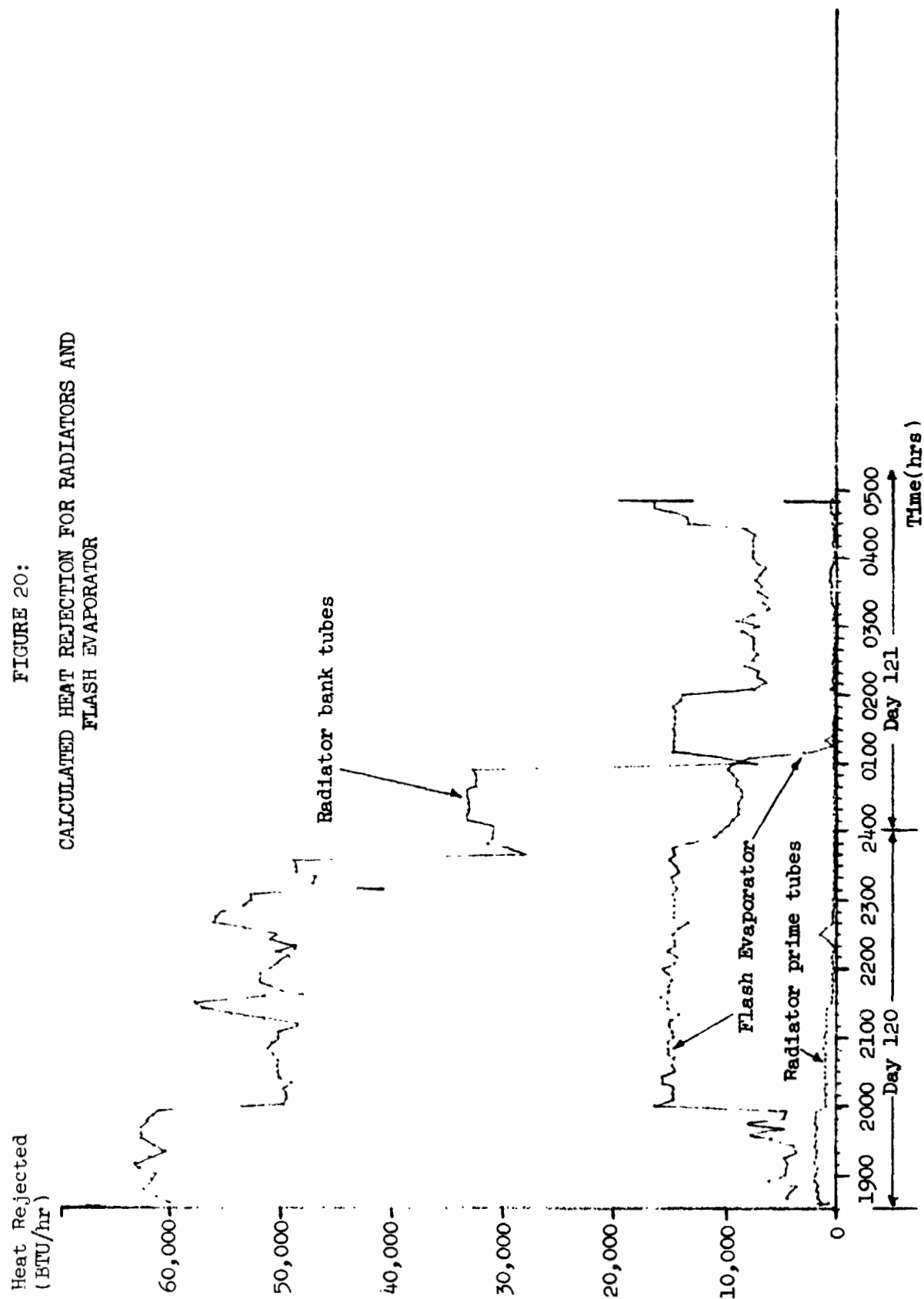


FIGURE 21:

CALCULATED HEAT REJECTION FOR
RADIATORS AND FLASH EVAPORATOR

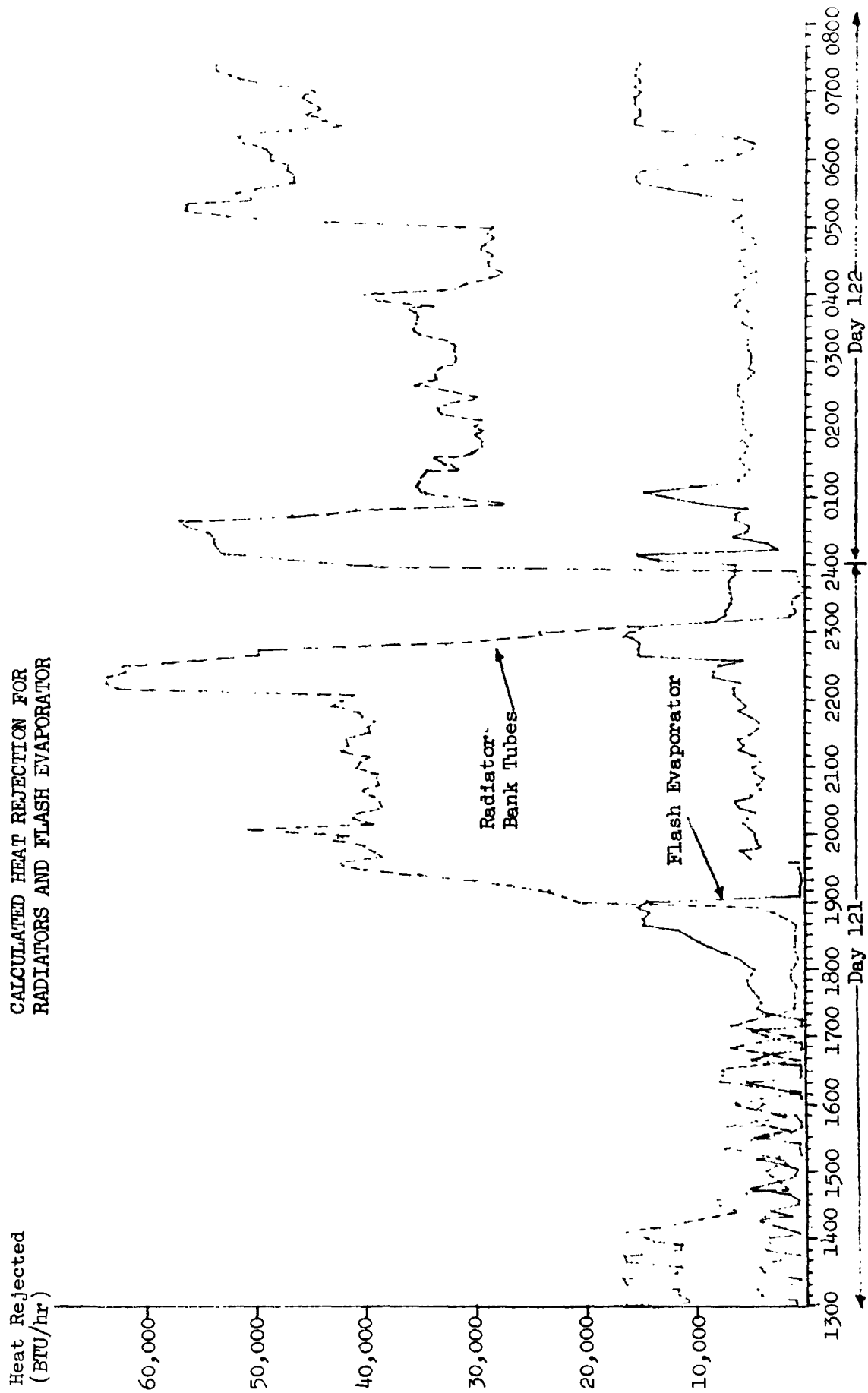
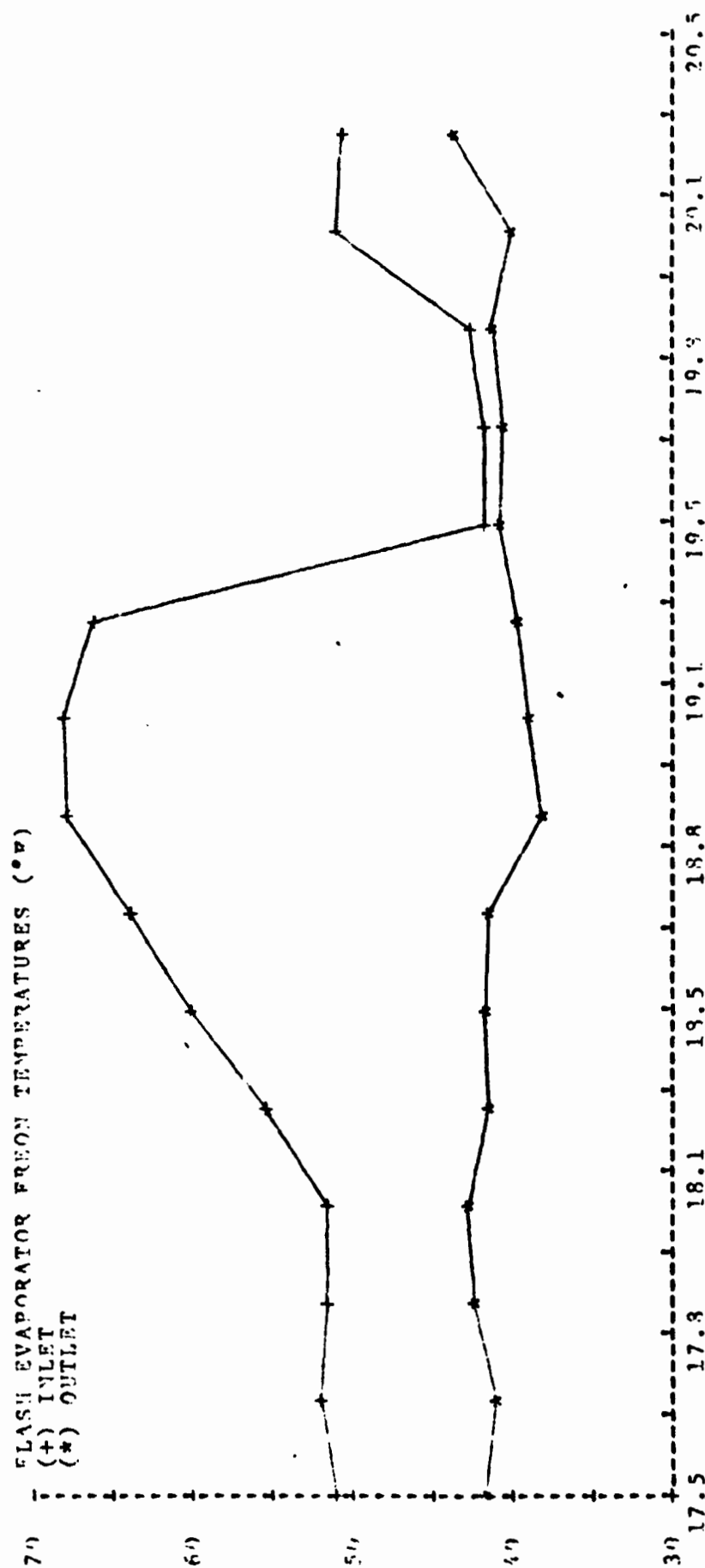


FIGURE 22

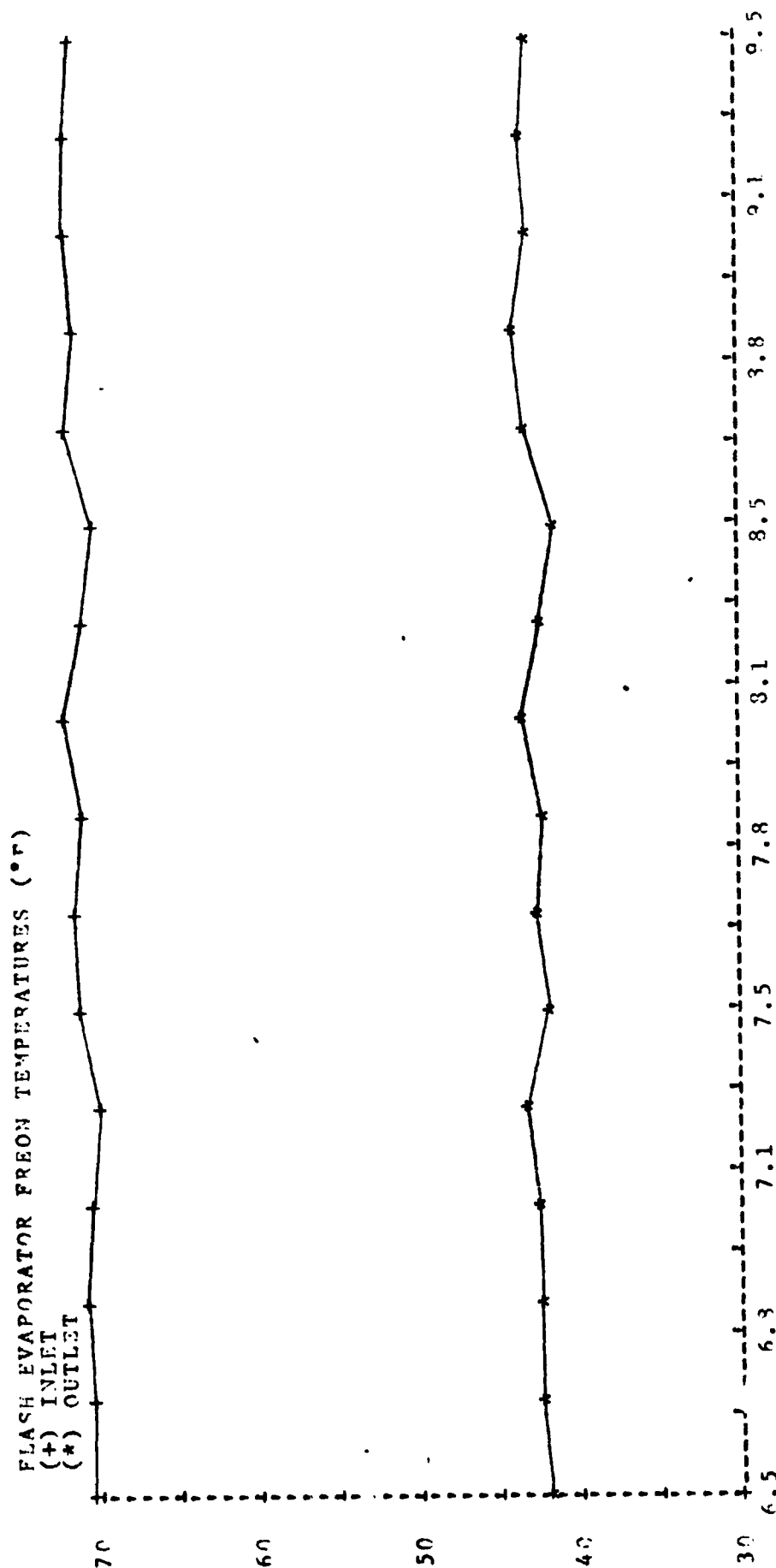
FLASH EVAPORATOR OUTLET TEMPERATURE RESPONSE TO RAPID CHANGES IN HEAT LOAD



TEST TIME ON DAY 121 (HOURS)

FIGURE 23

FLASH EVAPORATOR CHARACTERISTICS AT STEADY STATE HIGH HEAT LOADS



TEST TIME ON DAY 122 (HOURS)

FIGURE 24

FLASH EVAPORATOR CHARACTERISTICS AT LOW HEAT LOADS

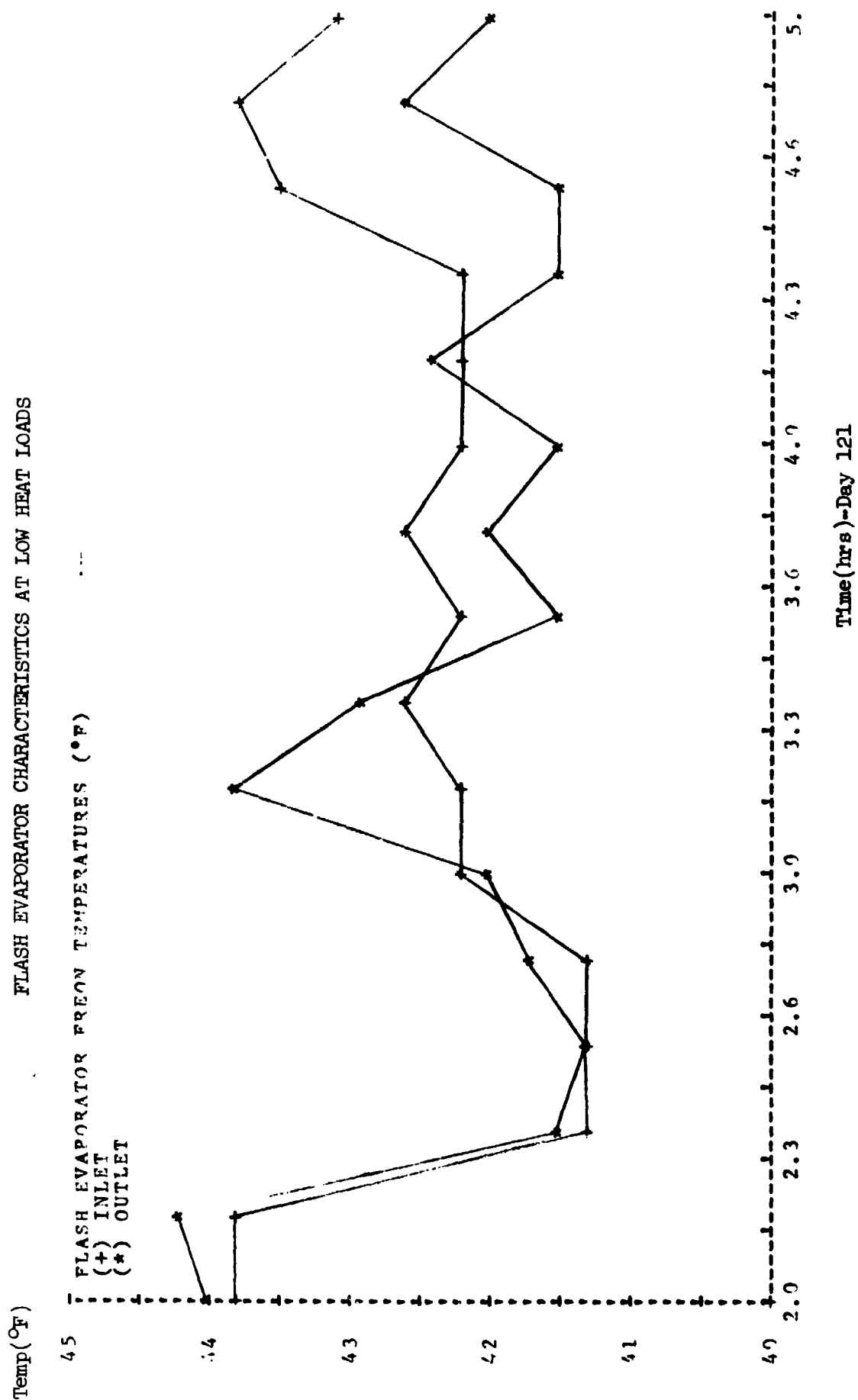
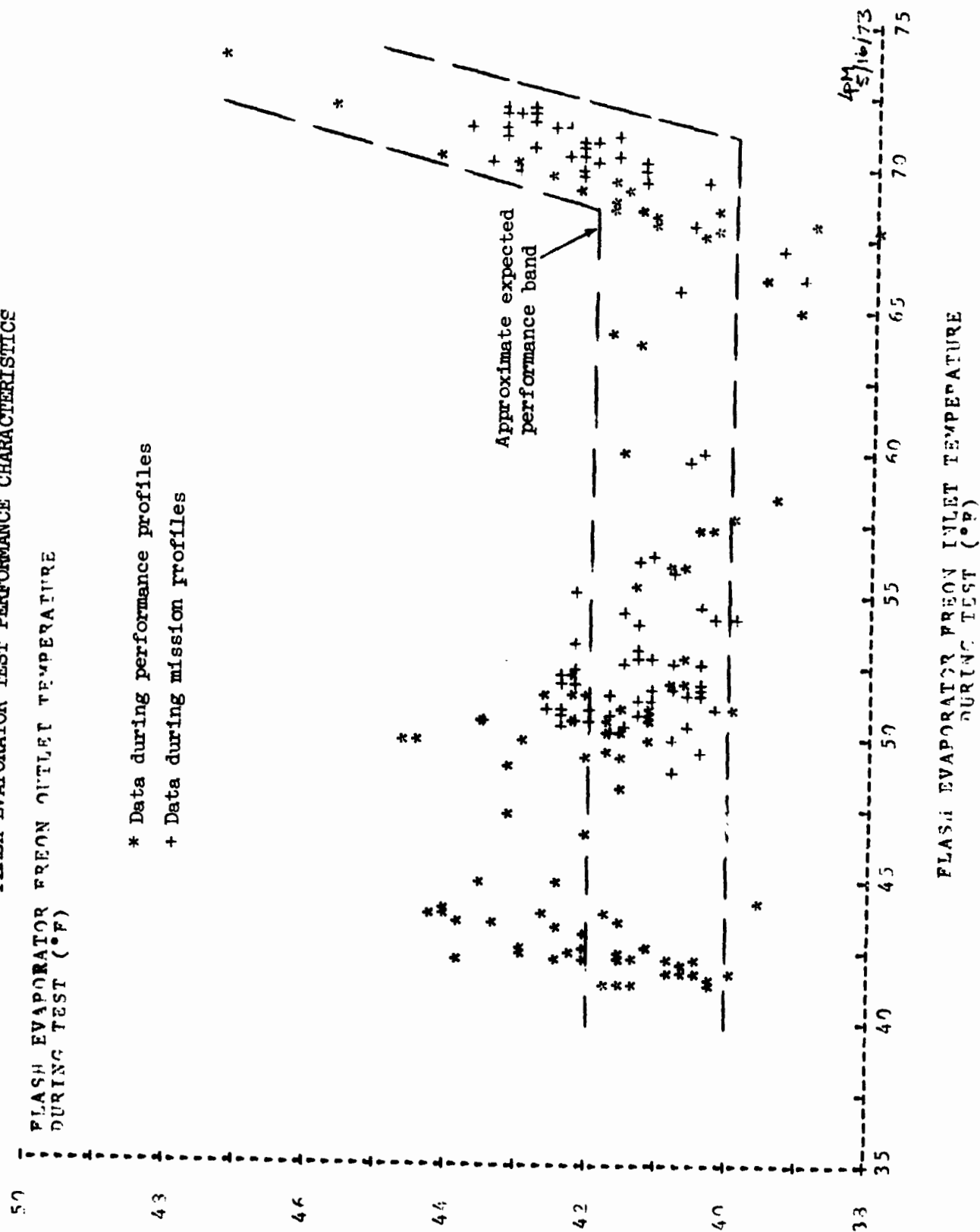


FIGURE 25:
FLASH EVAPORATOR TEST PERFORMANCE CHARACTERISTICS



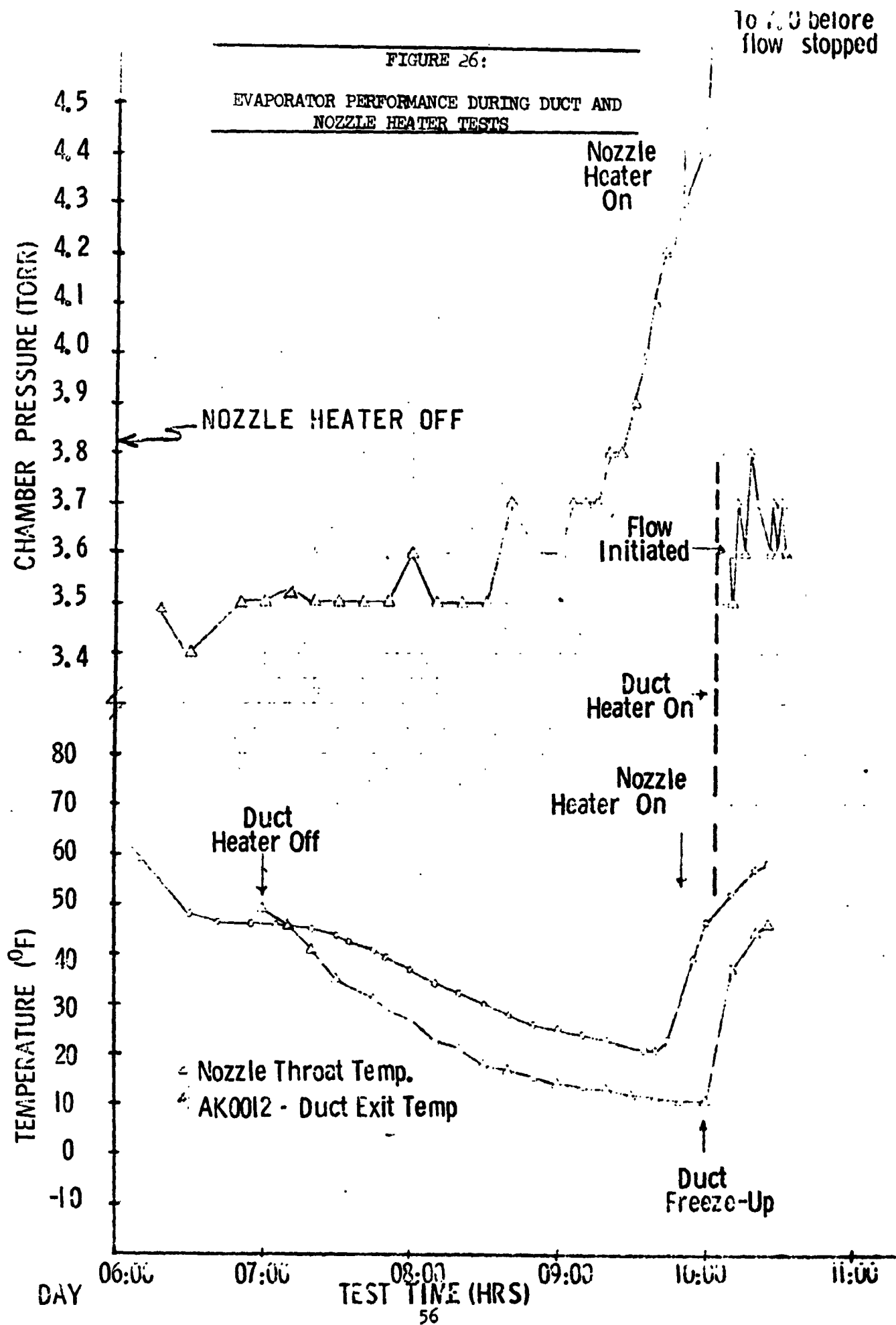
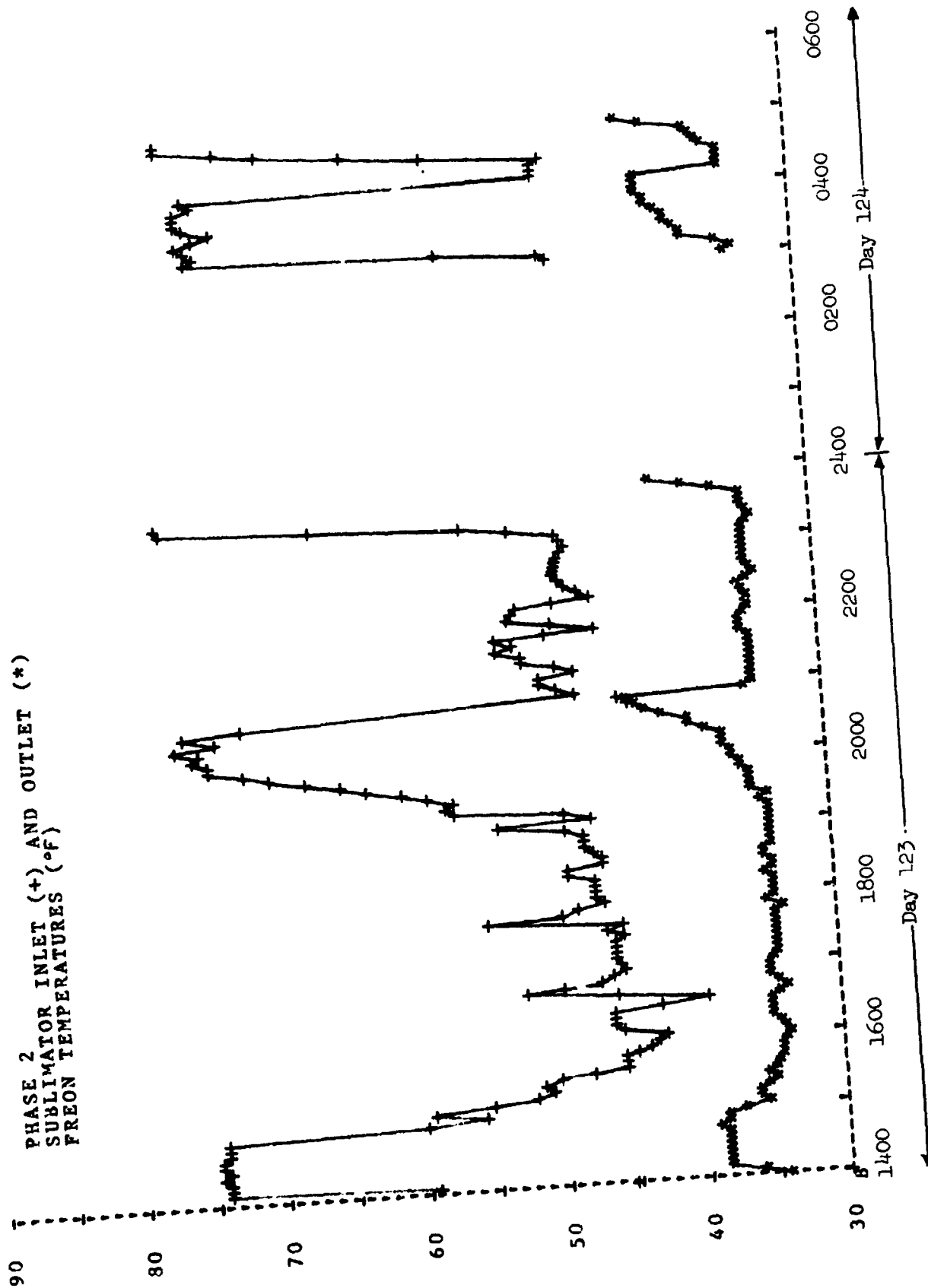


FIGURE 27:
SUBLIMATOR INLET AND OUTLET TEMPERATURES



SUBLIMATOR OUTLET VS INLET TEMPERATURE

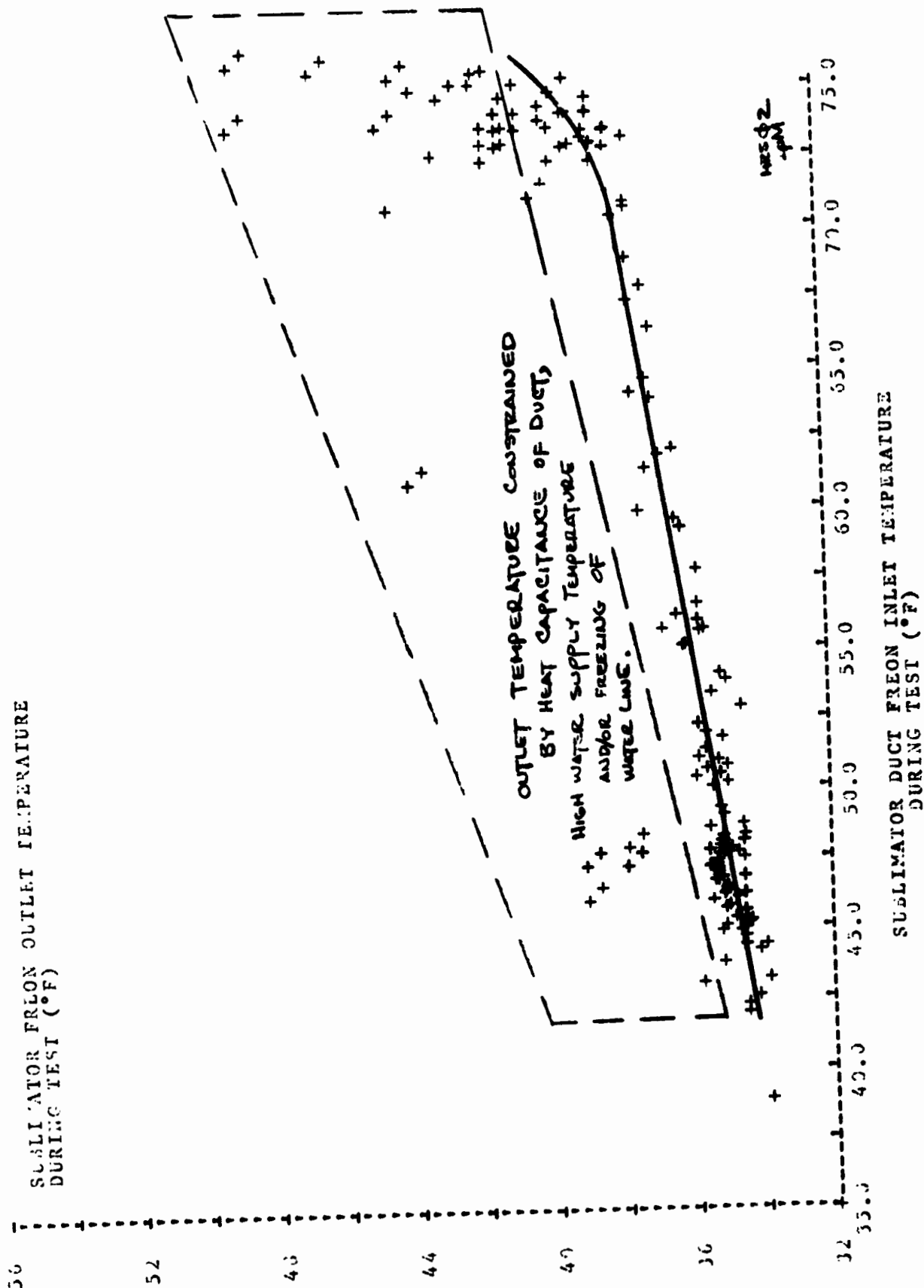


FIGURE 29:
RADIATOR AND SUBLIMATOR
HEAT REJECTED

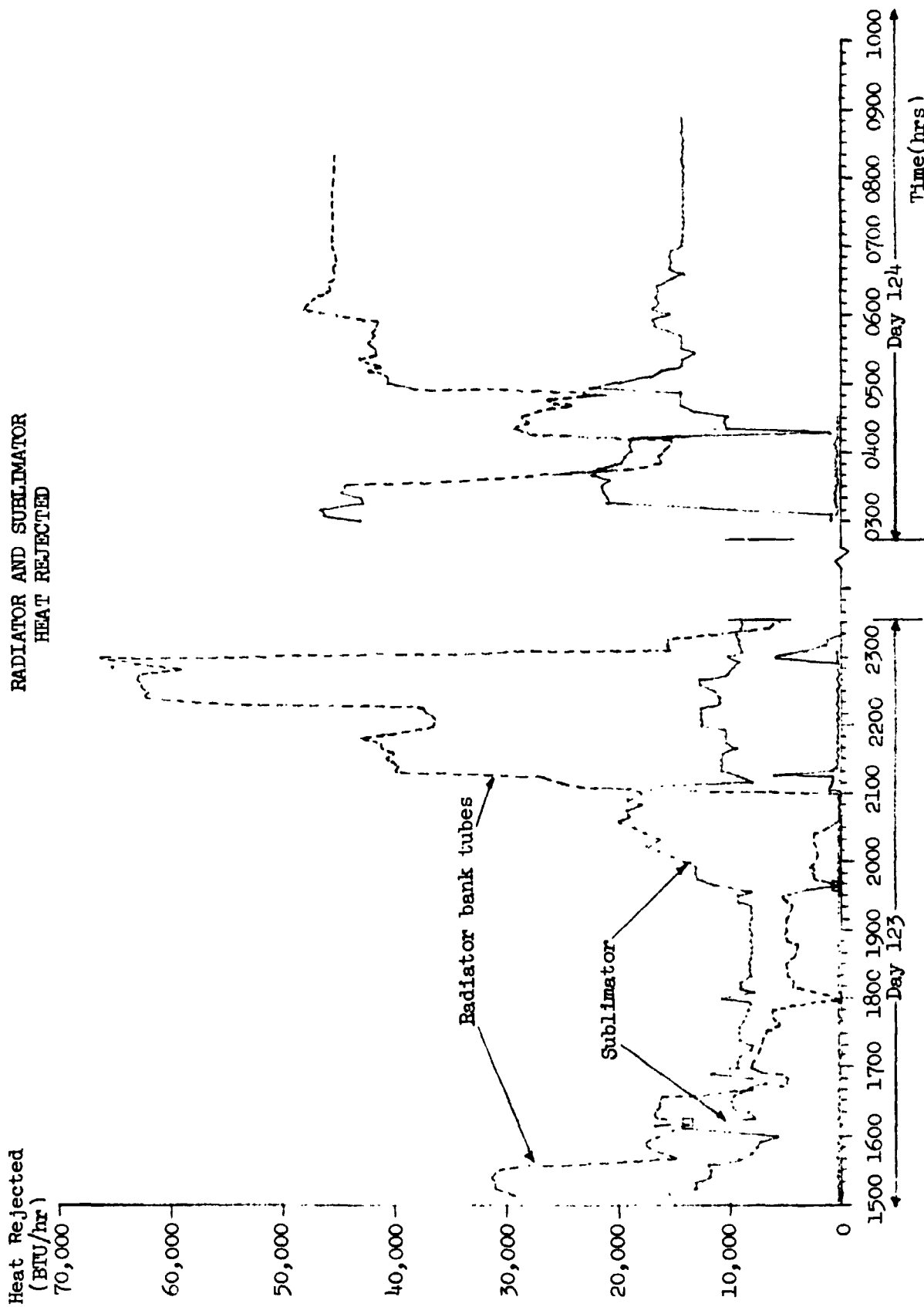


FIGURE 30:

WATER FLOW TO TANK DURING FLASH EVAPORATOR TESTING

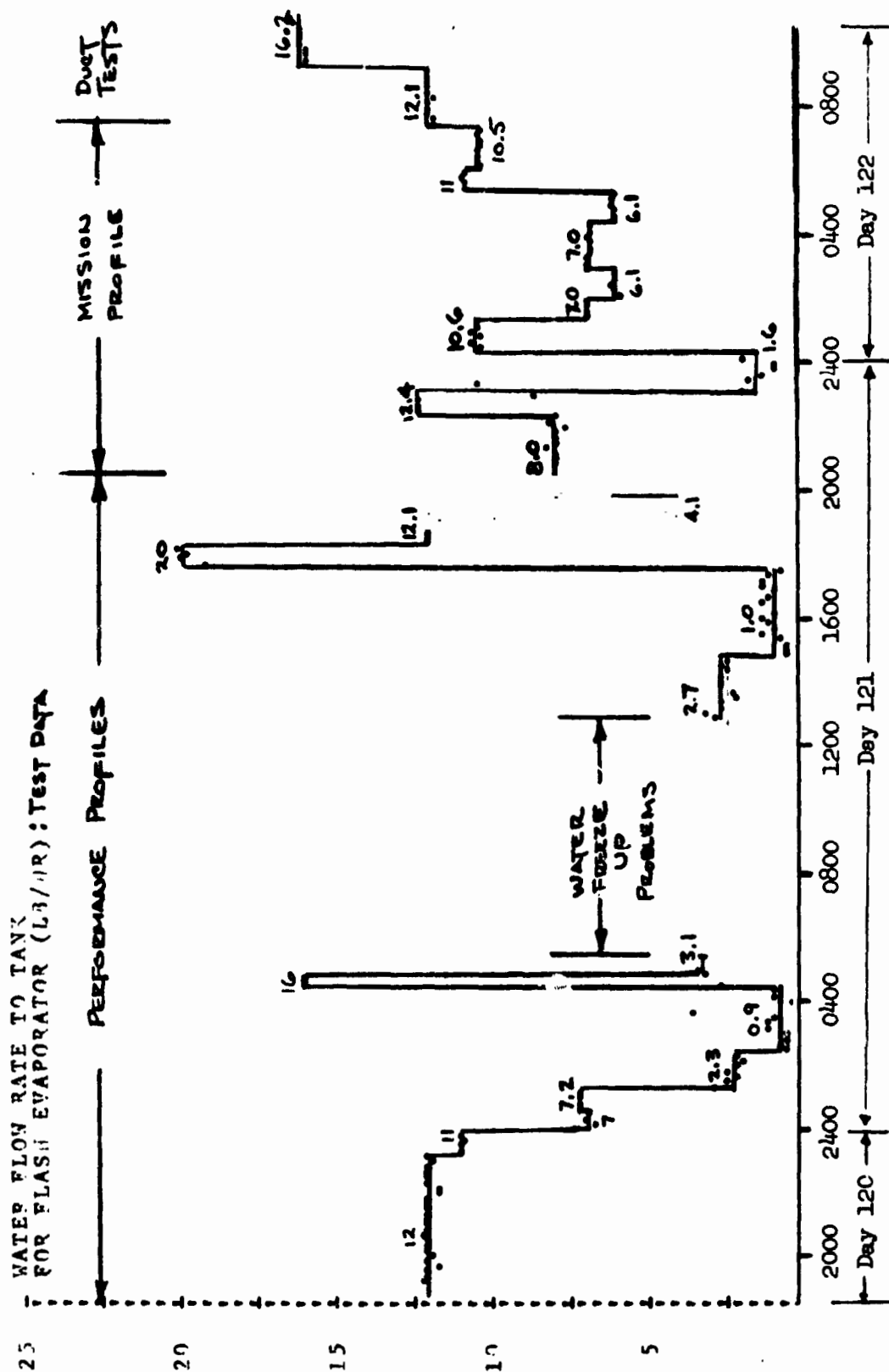


FIGURE 31:
WATER FLOW TO TANK DURING SUBLIMATOR TESTING

DESIGN
UNIT

MISSILE

POCKET

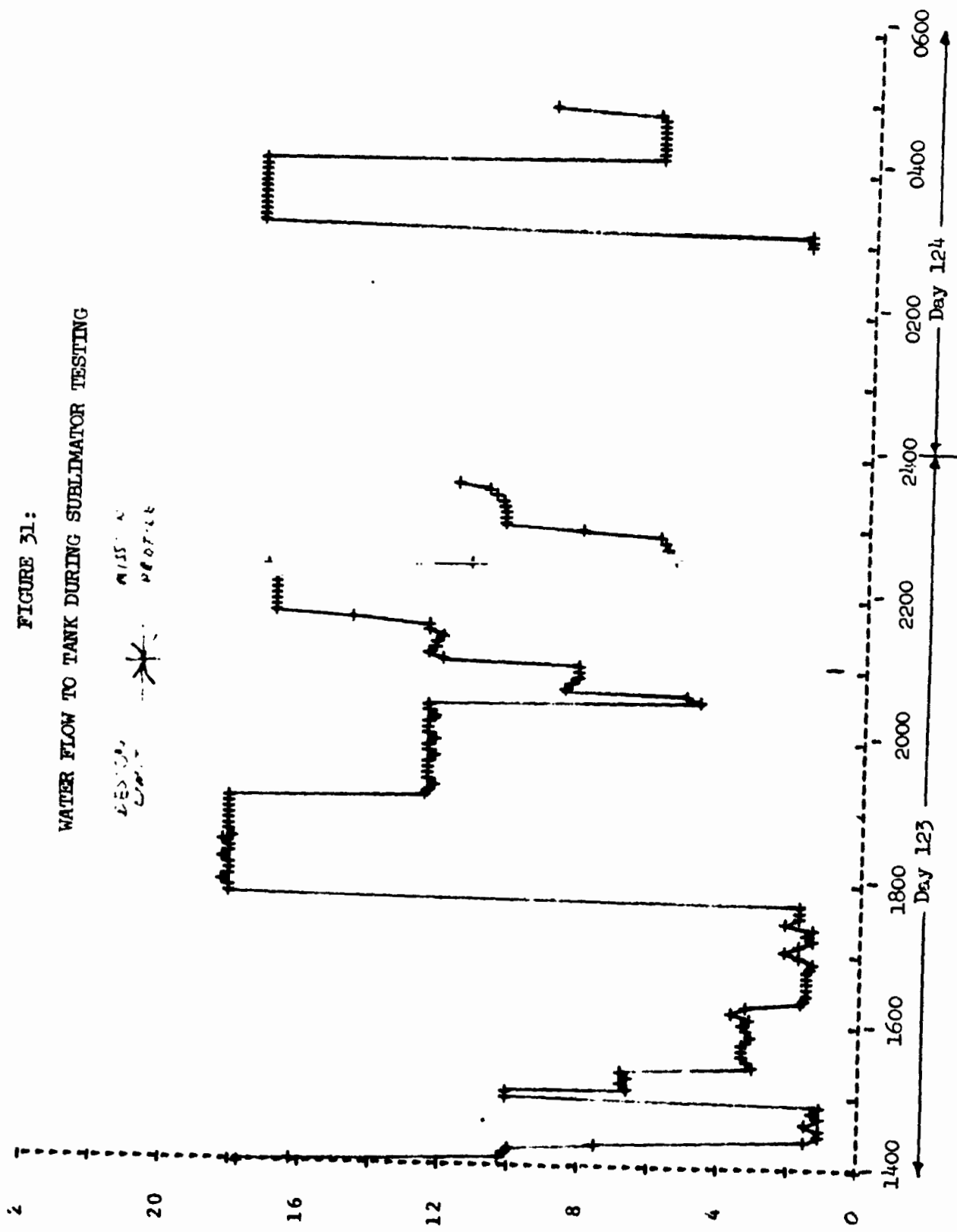


FIGURE 32:

WATER QUANTITY DURING MAXIMUM FLUX AND HEAT LOAD TEST POINT

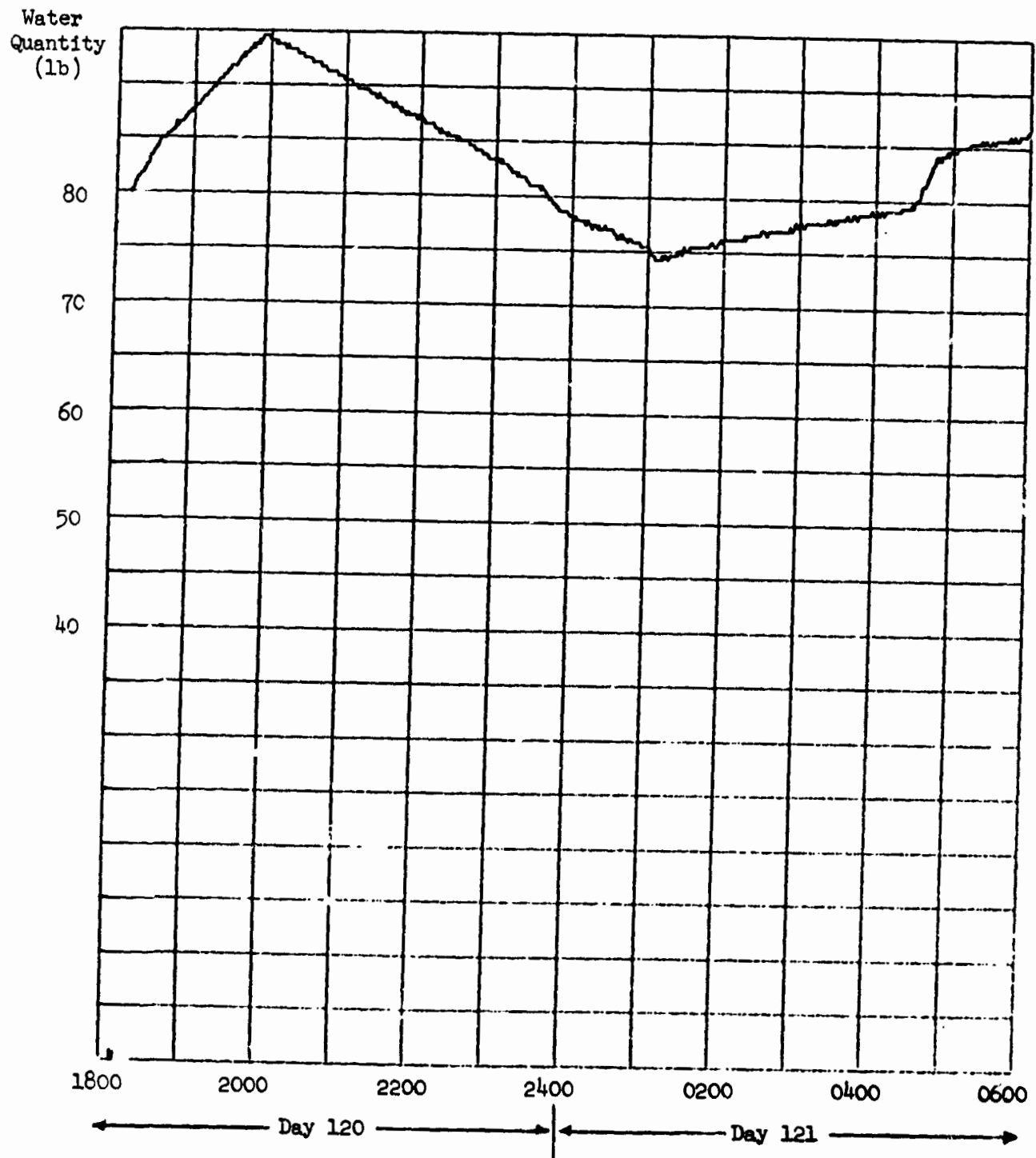


FIGURE 33:

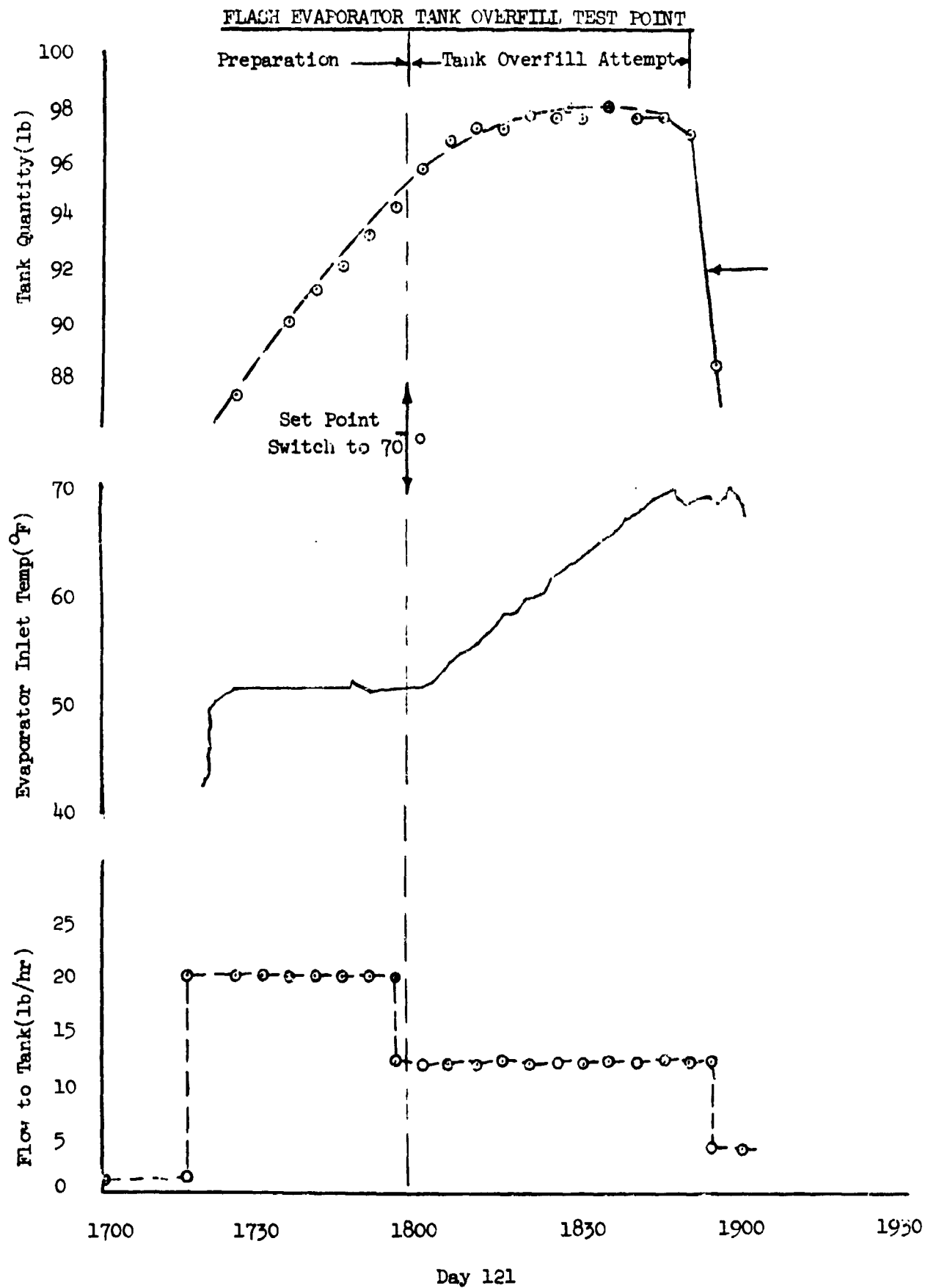
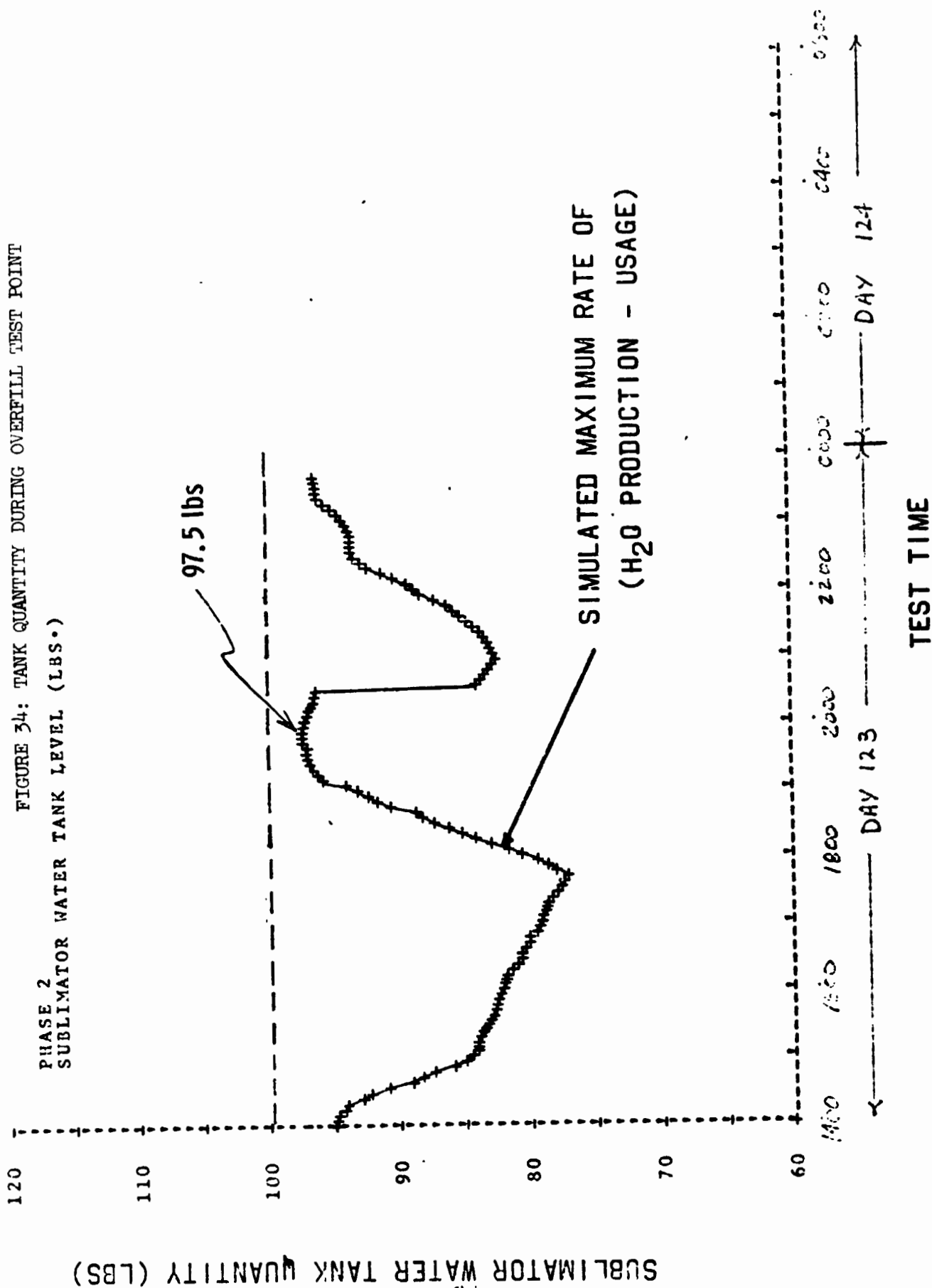


FIGURE 34: TANK QUANTITY DURING OVERFILL TEST POINT

PHASE 2
SUBLIMATOR WATER TANK LEVEL (LBS.)

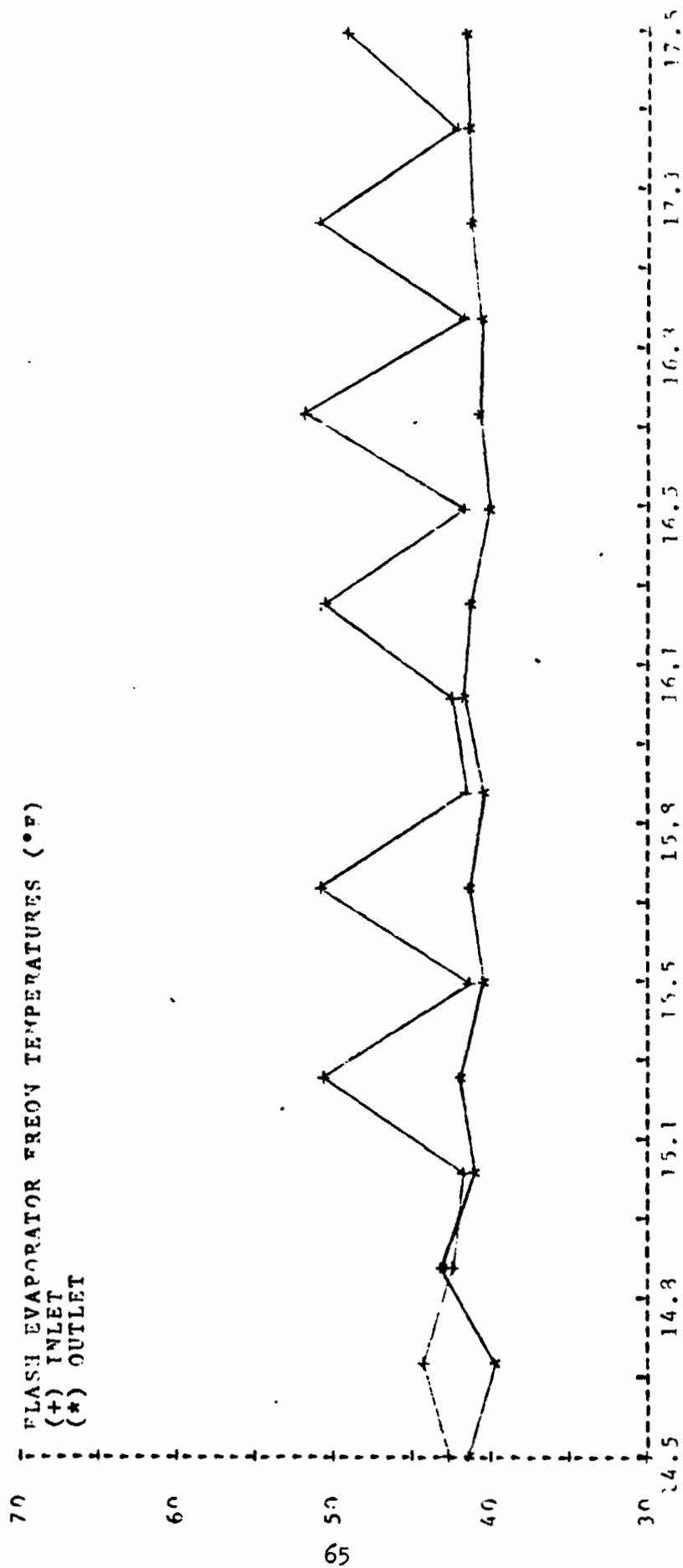


SUBLIMATOR WATER TANK QUANTITY (LBS)

FIGURE 35

FLASH EVAPORATOR OUTLET TEMPERATURE

RESPONSE TO CYCLIC SET POINT CHANGES



TEST TIME ON DAY 121 (HOURS)

APPENDIX I

SUMMARY OF IMPOSED IR ENVIRONMENT

FIGURE I-1
TOTAL IR FLUX ON PANEL 1
(BTU/hr ft²)

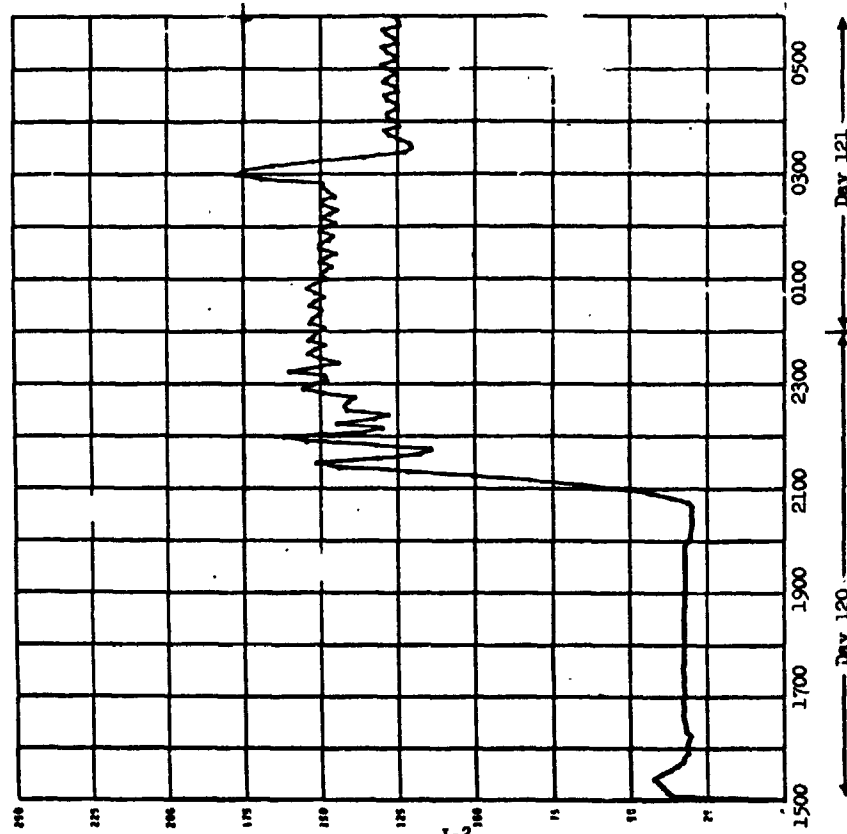


FIGURE I-1
(Continued)

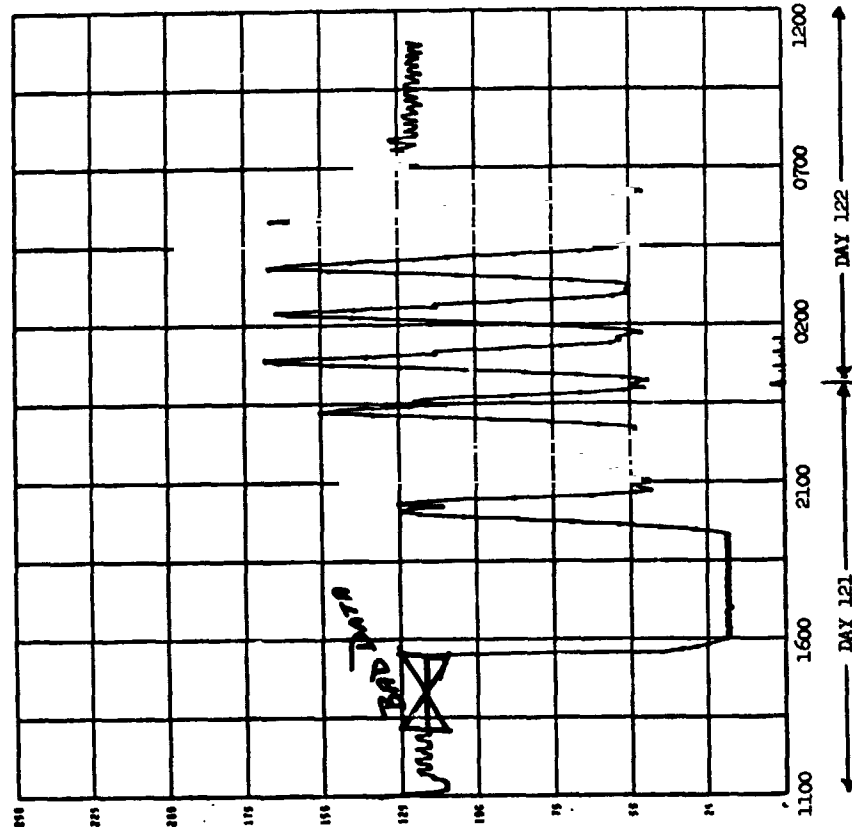


FIGURE I-1
(Continued)

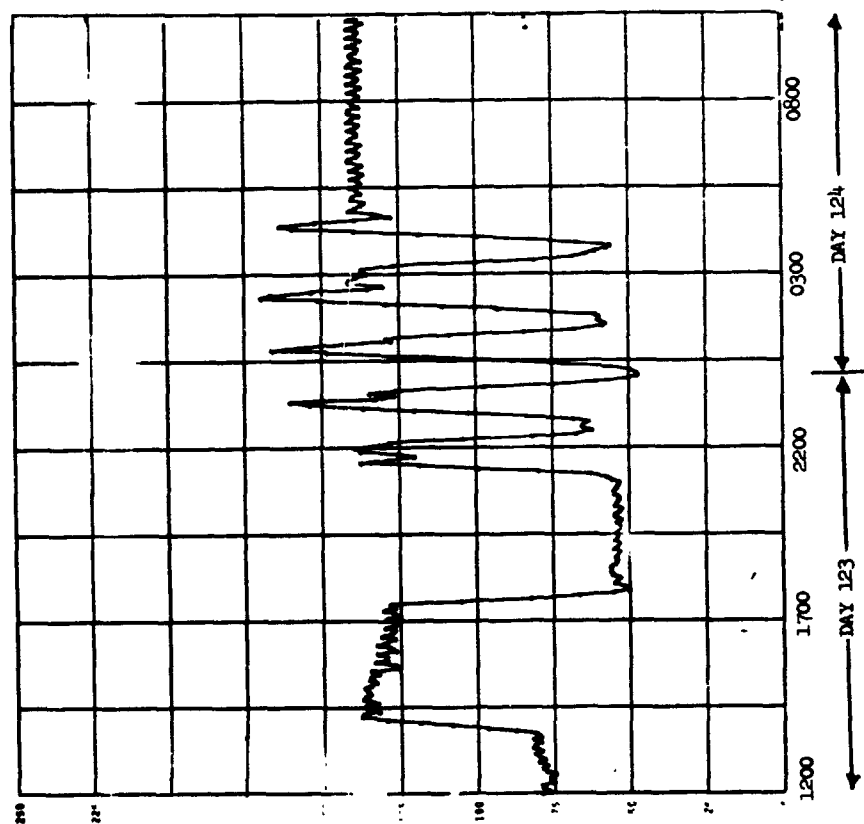


FIGURE I-2
TOTAL IR FLUX ON PANEL 2
(BTU/hr ft²)

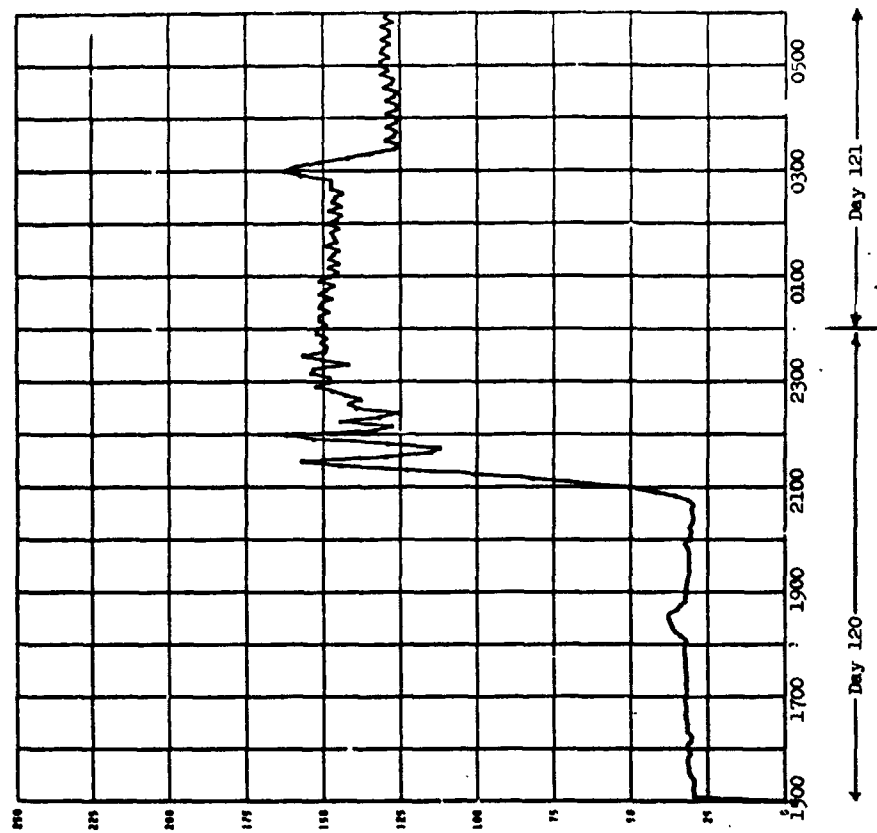


FIGURE I-2
(Continued)

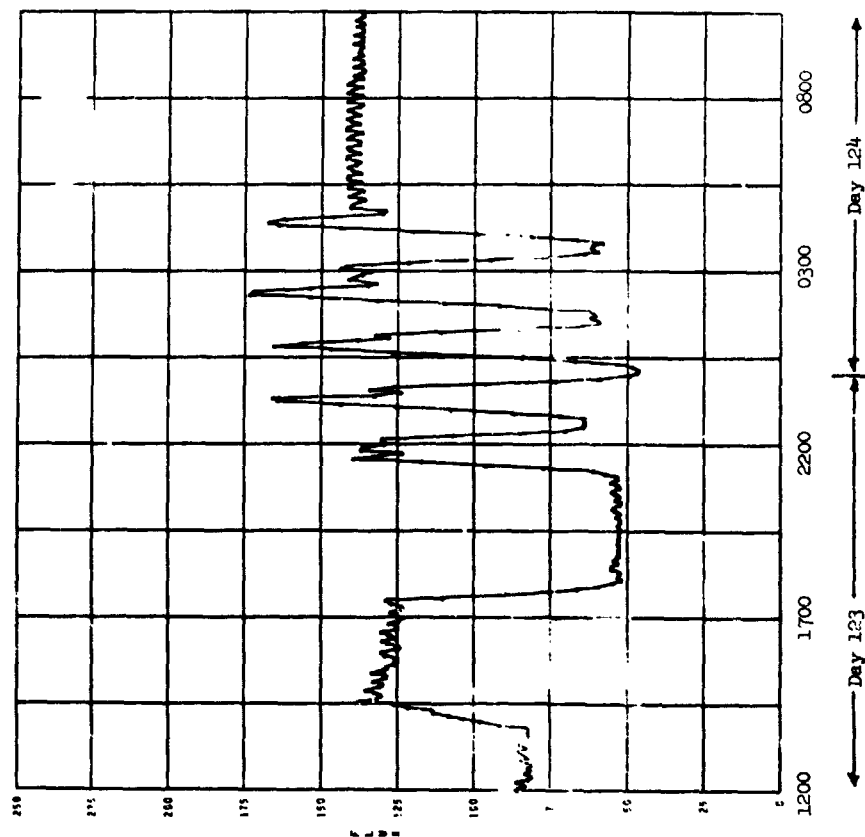


FIGURE I-2
(Continued)

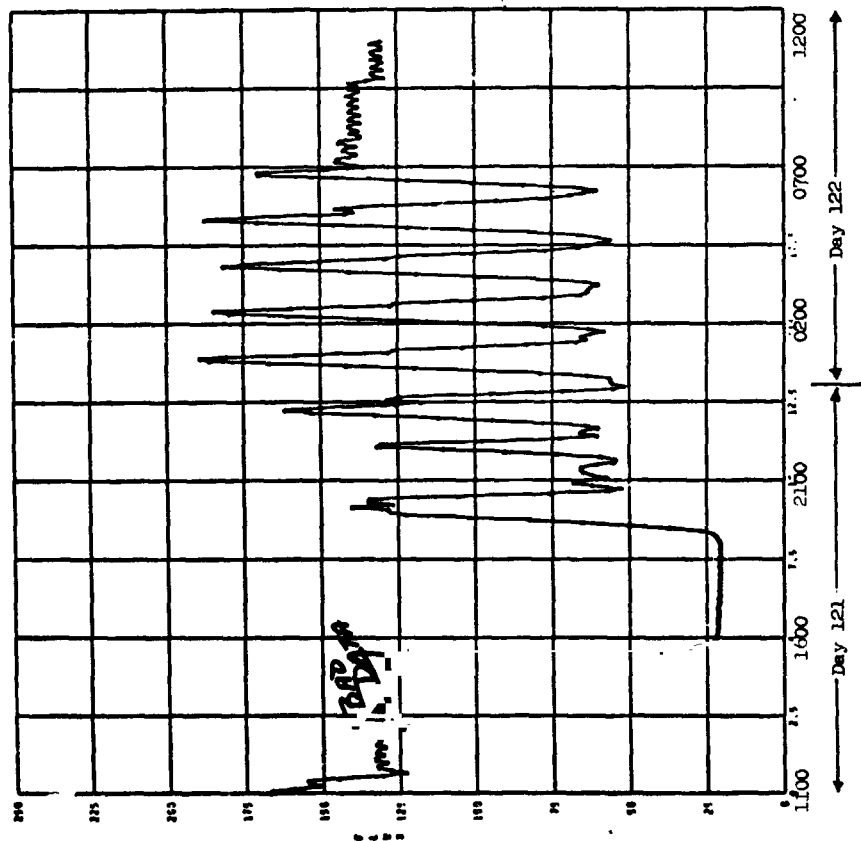


FIGURE 1-3
TOTAL IR FLUX ON PANEL 3
(BTU/hr ft²)

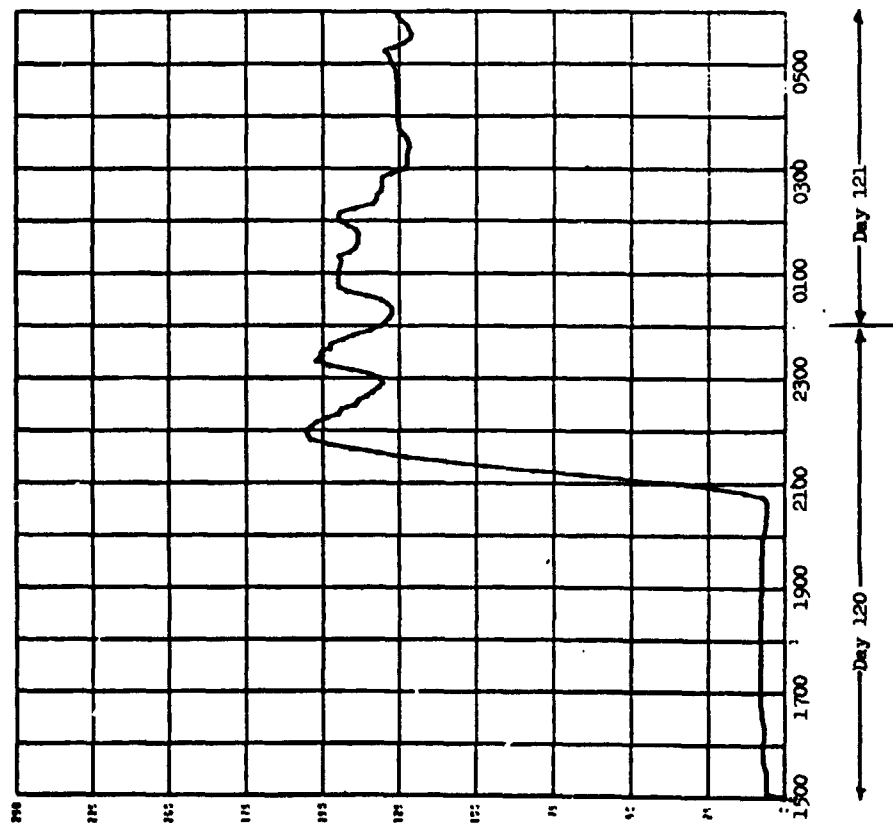


FIGURE 1-3
(Continued)

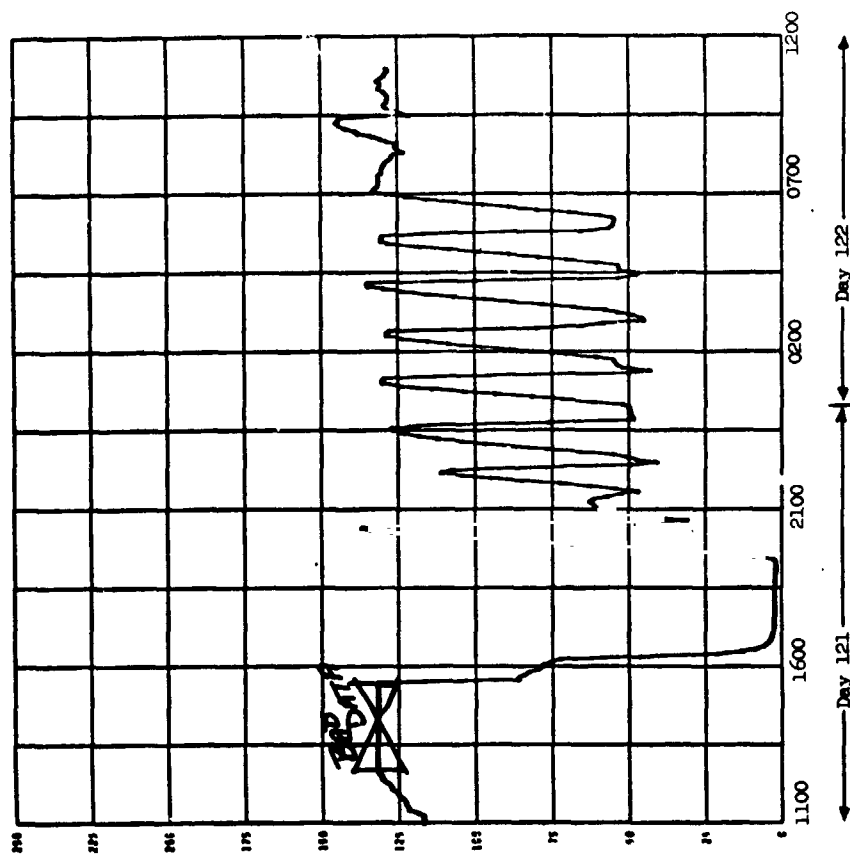


FIGURE I-4
TOTAL IR FLUX ON PANEL 4
(BTU/hr ft²)

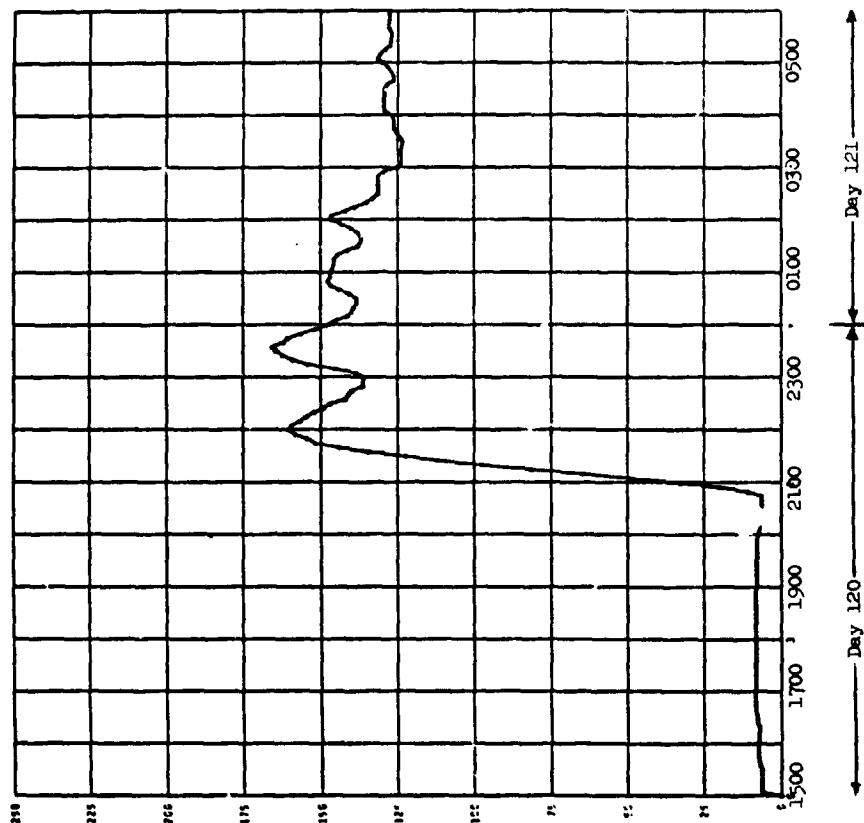


FIGURE I-3
(Continued)

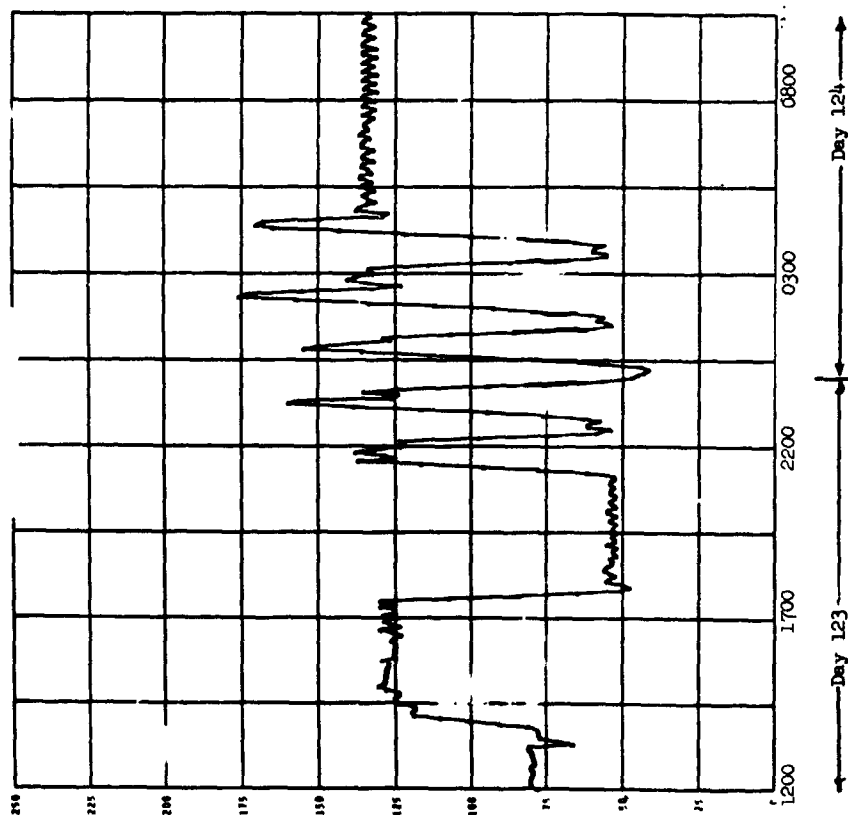


FIGURE I-4
(Continued)

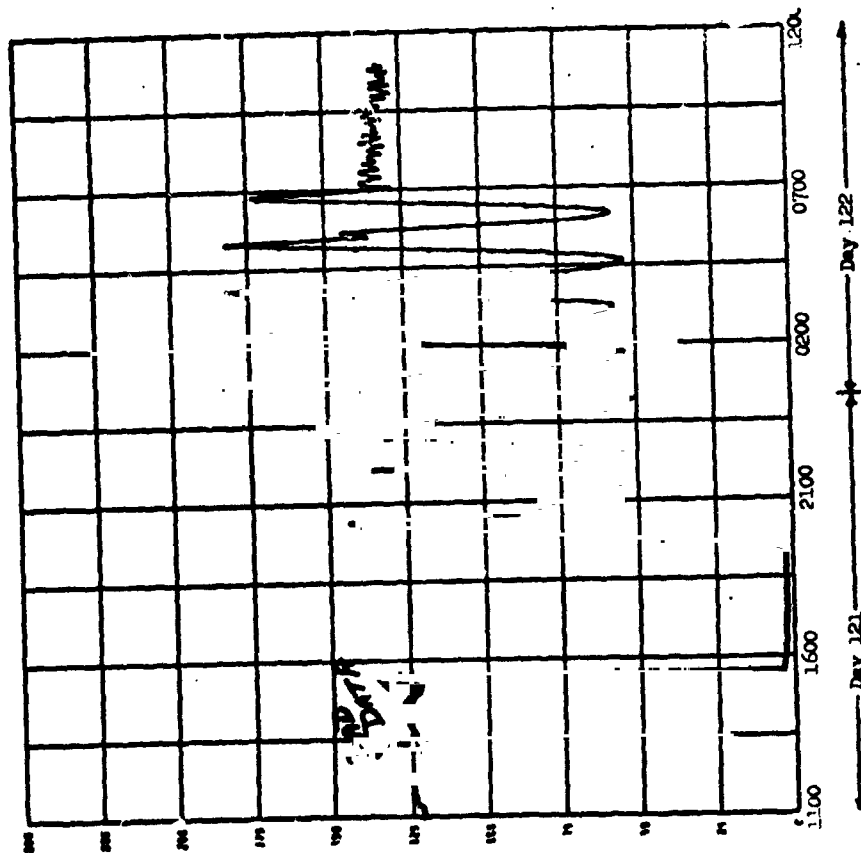


FIGURE I-4
(Continued)

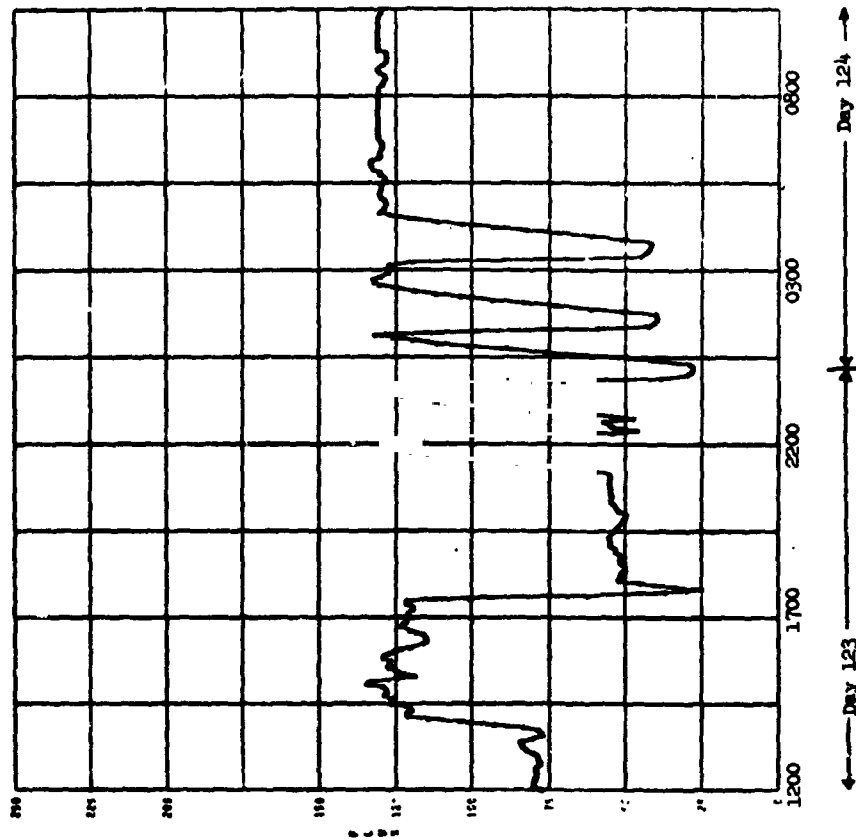
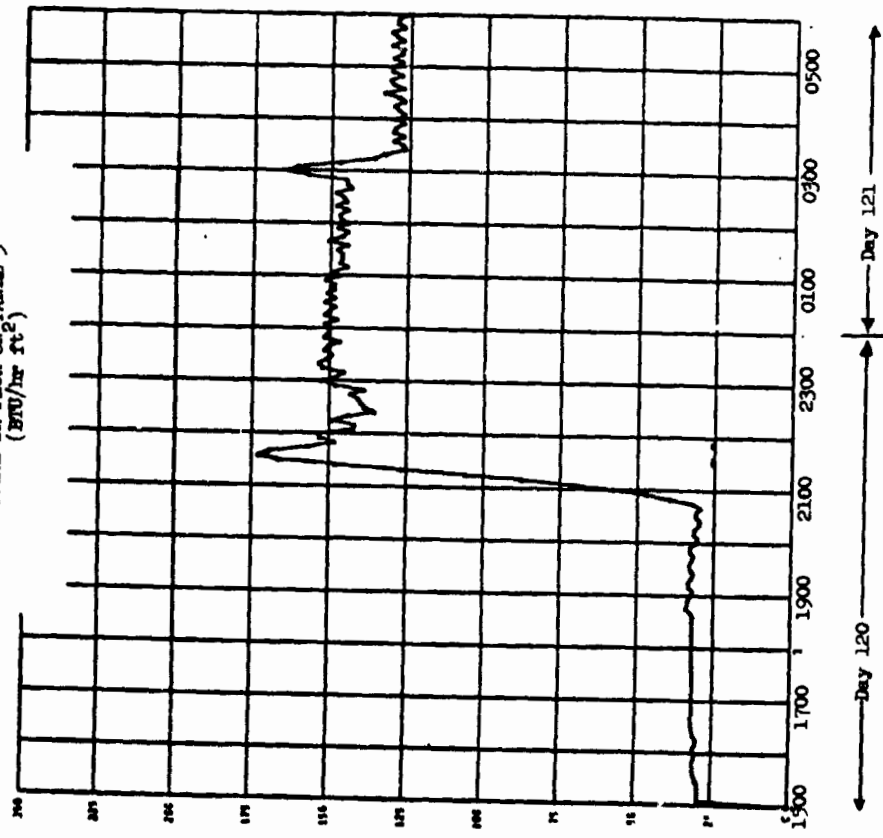


FIGURE I-5
TOTAL IR FLUX ON PANEL 5
(BTU/hr ft²)



I-8

FIGURE I-5
(Continued)

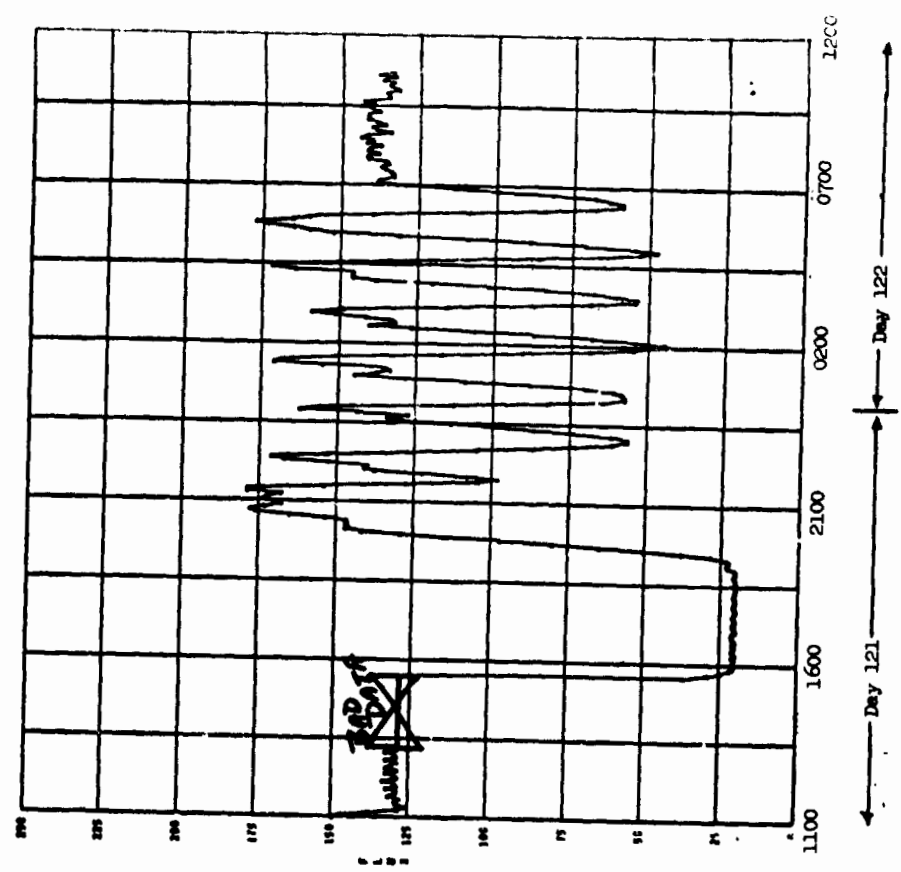


FIGURE I-6
TOTAL IR FLUX ON PANEL 6
(BTU/hr ft²)

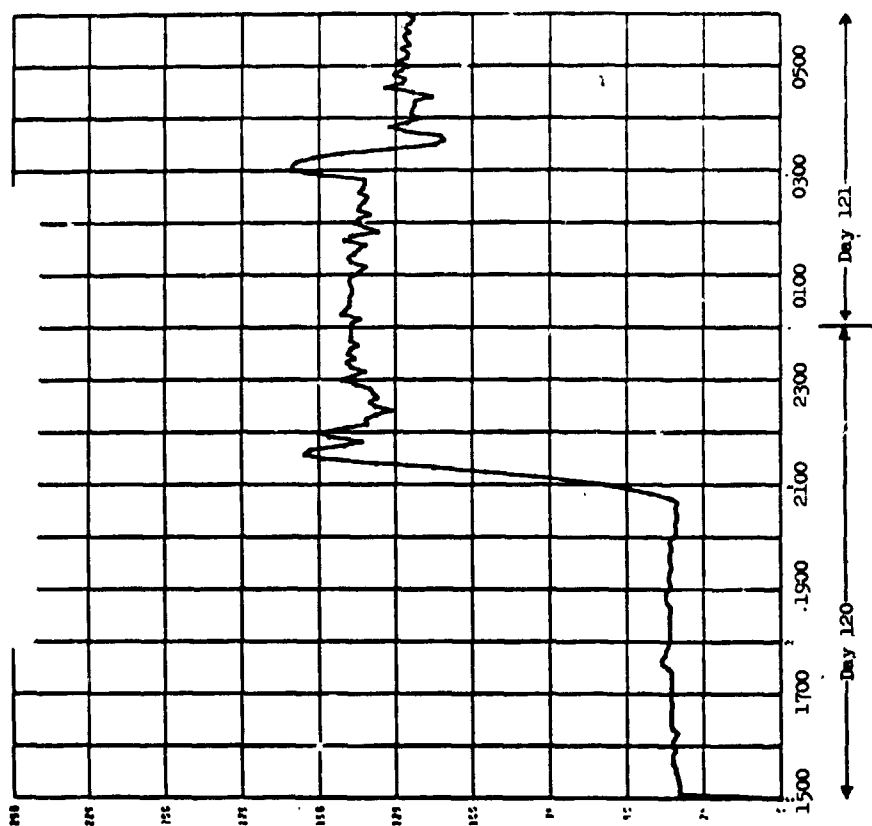


FIGURE I-5
(Continued)

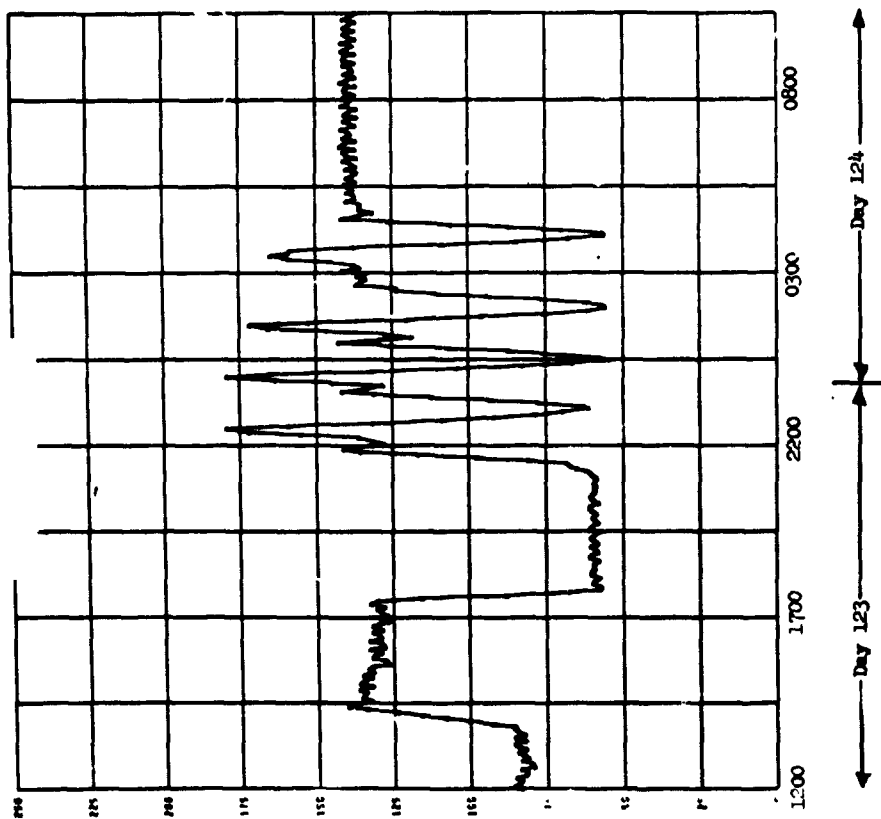


FIGURE I-6
(Continued)

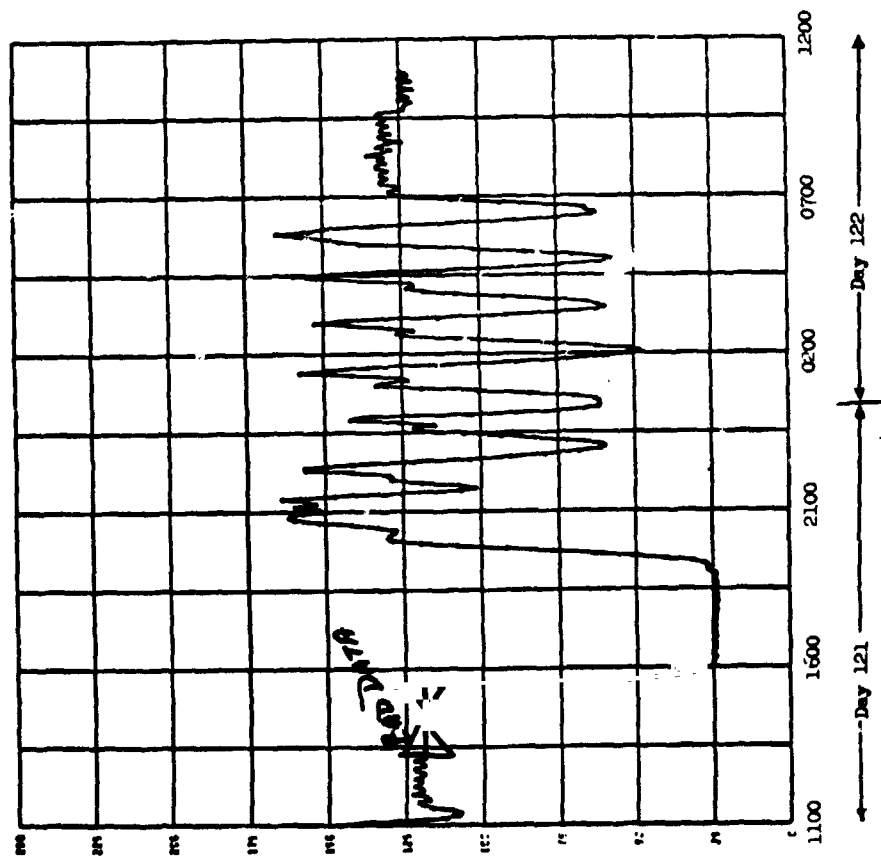


FIGURE I-6
(Continued)

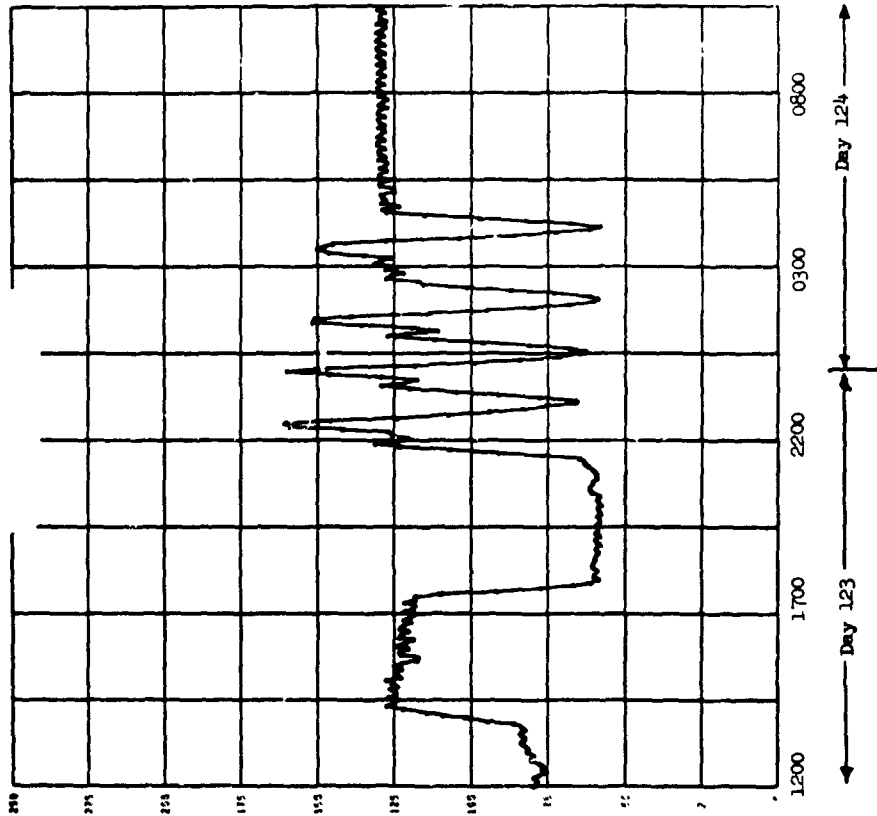


FIGURE I-7
TOTAL IR FLUX ON PANEL 7
(BTU/hr ft²)

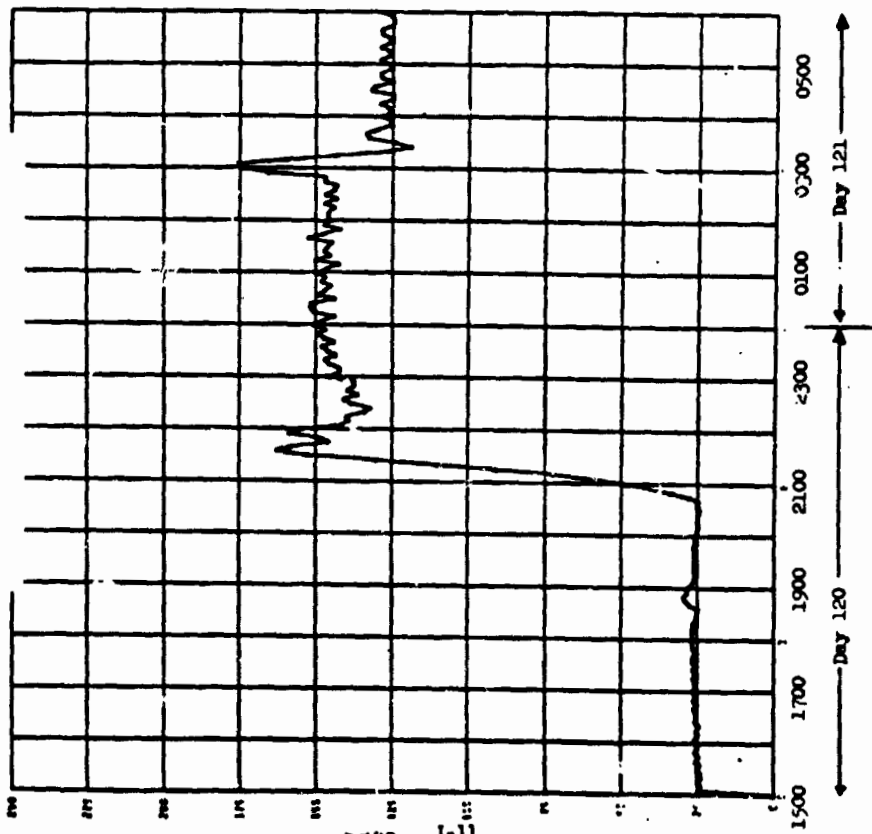


FIGURE I-7
(Continued)

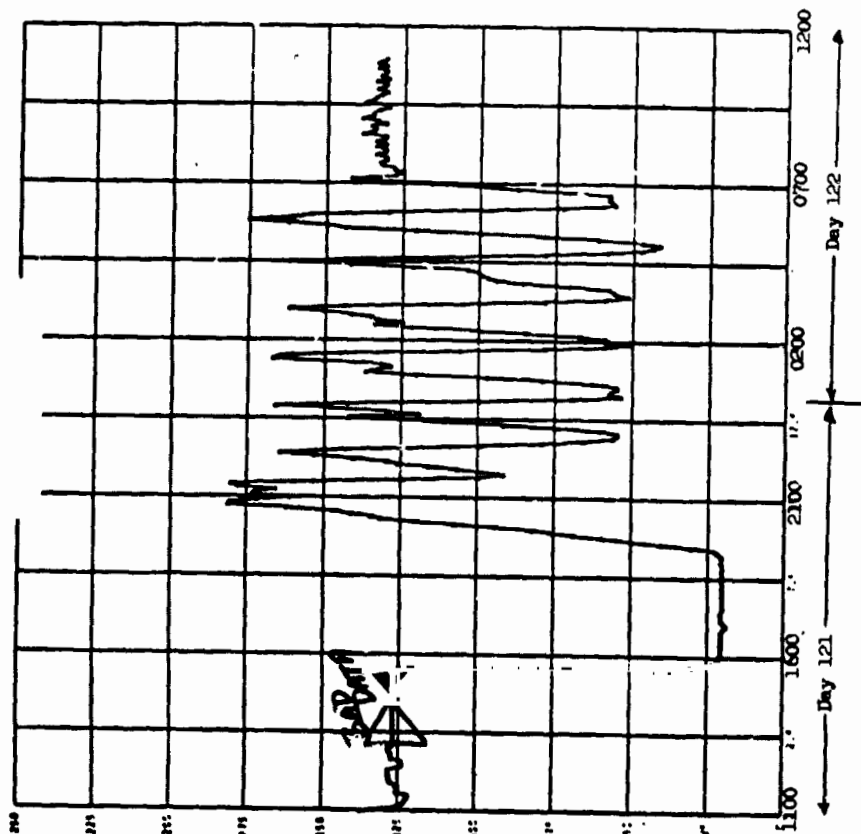
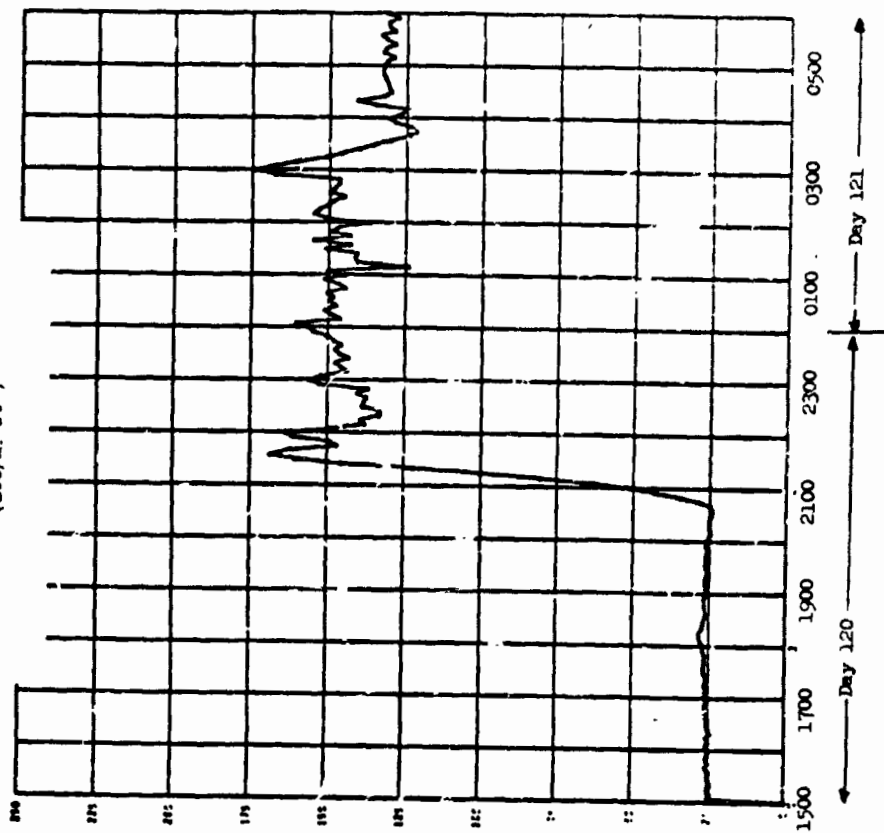


FIGURE I-8
TOTAL IR FLUX ON PANEL 8
(BTU/hr. ft²)



1 FIGURE I-7
(Continued)

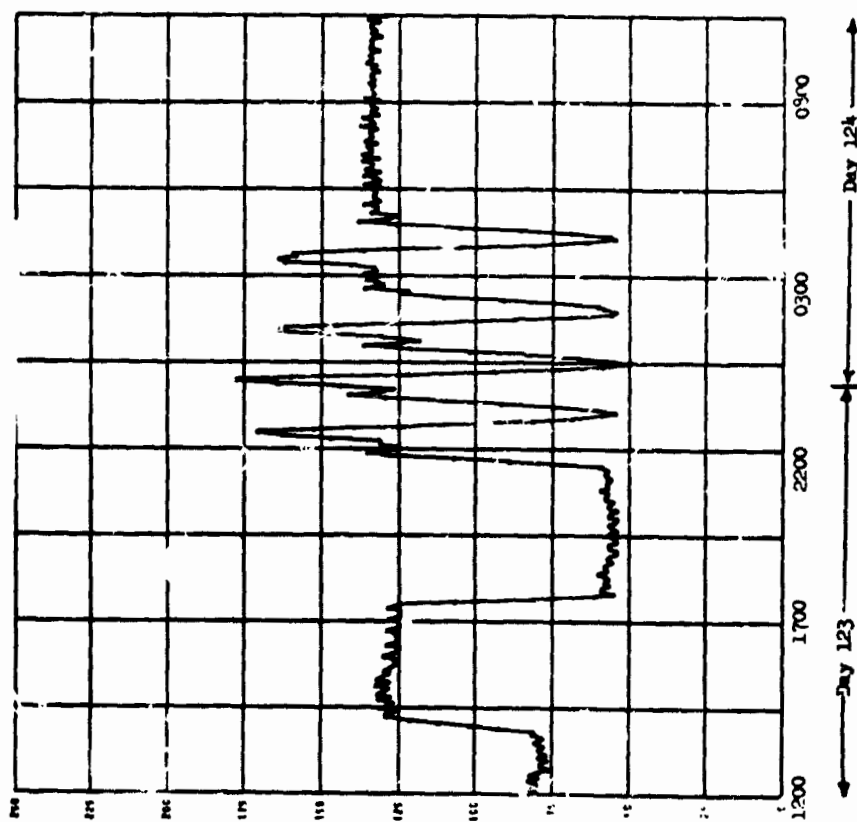
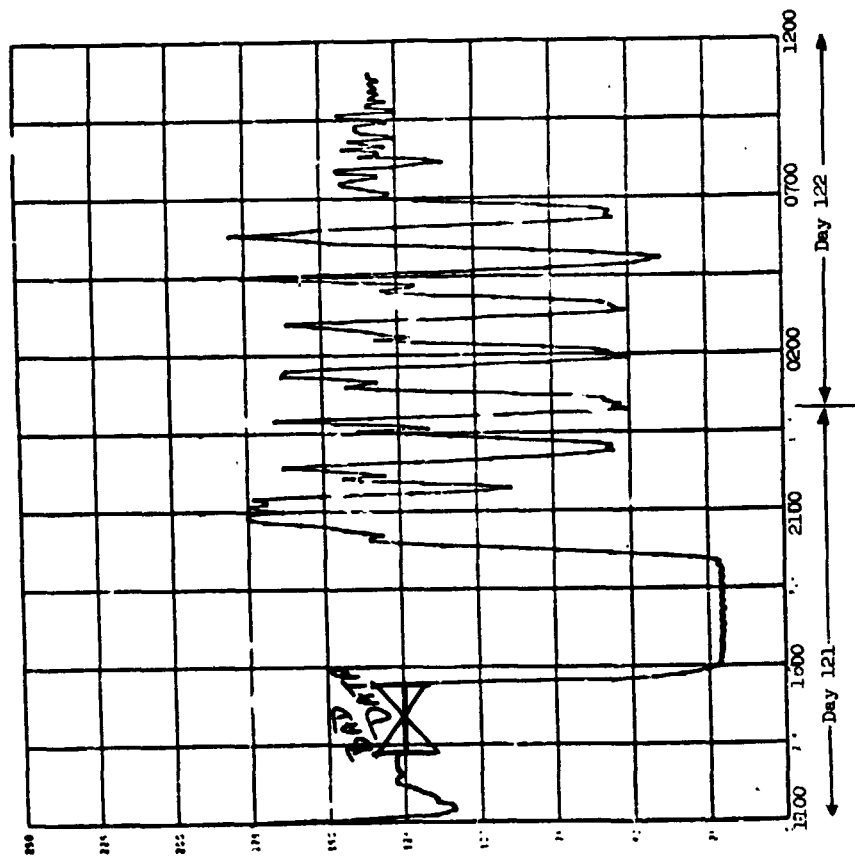
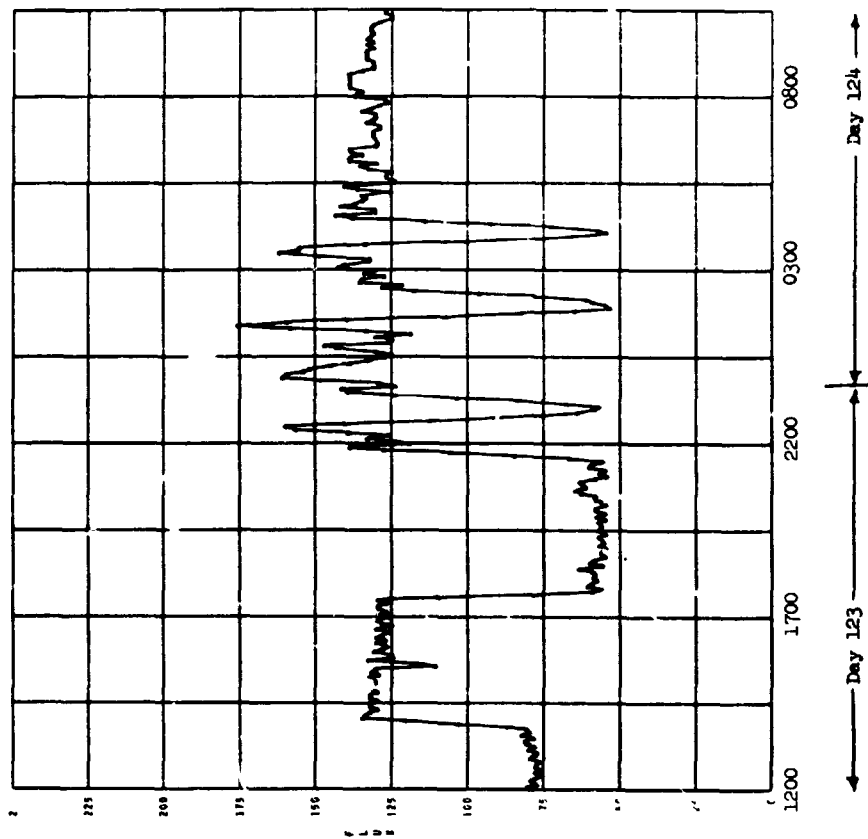


FIGURE I-8
(Continued)



I-13

FIGURE I-8
(Continued)



APPENDIX II

INTEGRATED ACTIVE THERMAL CONTROL SYSTEM TEST OPERATIONS REPORT

One week of thorough integrated thermal control system testing was completed on May 4, 1973. Two integrated active control systems were tested: the radiator - flash evaporator - water supply system was tested for 33 hours; and the radiator - sublimator - water supply system was tested for approximately 20 hours. Planned testing called for approximately 45 hours of operation for each integrated system, but water line installation inadequacies for the flash evaporator and sublimator systems, and start up problems for the sublimator system curtailed planned operations. General test operations are summarized below.

30 April 1973 (day 120)

| | |
|-------------|---|
| 00:00 | Test team on station |
| 03:08 | MRS (modular radiator system) valves set for γ configurations |
| 04:30 | Pump down started |
| 09:00 | Flash Evaporator (F.E.) secondary water supply reads 5°F. (Re-established at 12:00 noon) |
| 11:30 | Chamber at test conditions 162°F inlet temp. to MRS established |
| 12:00 | F.E. preops initiated |
| 13:00 | Lost pumps to I.R. simulators (IRS) 3 and 4. LN ₂ flowed to these panels to get proper envisionments. Air in F.E. water lines. Deaeration procedures initiated. |
| 15:30 | Deaeration of water lines complete. Primary water line temp. drops to 33°F. F.E. preops re-initiated on secondary water supply line. |
| 16:20 | F.E. preops completed |
| 16:20-17:00 | Baratron calibration. |
| 17:00-17:20 | Fuel Cell (F.C.) water supply pressure adjusted for positive flow. |
| 17:28 | Began timelines; clock set at zero |
| 18:00 | F.C. water inlet flow set to 20 lb/hr to make up for lost time |
| 18:12 | F.C. water set to 12 lb/hr. Water tank at 80 lbs. |
| 18:12 | Timeline clock reset to zero |
| 18:34 | MRS set point to 50°F. F.E. outlet temperature oscillations of 3°F |
| 19:35 | F.E. outlet temperature oscillations drop to 1.5°F |

19:56 MRS set point to 70°F. Water tank at 94.5 lbs.
 20:00 F.E. water tank pressure set from 27.5 to 28.5 psi to get
 16 lb/hr flowrate into evaporator
 20:35 IRS begin transient to 150 BTU/hr/ft²
 21:49 As IRS approach 150 BTU/hr/ft², MRS cannot control to 70°F.
 MRS outlet goes to 73°F causing F.E. outlet to go to 43°F
 22:17 IRS zone power reduced to get MRS mix of 70°F
 22:20 Lost power to IRS zones 1 and 2
 22:25 IRS zones not stable. IRS zone requirement changed to 140 BTU/hr/ft²
 22:39 MRS set point goes to 40°F. MRS mixed outlet goes to 65.8°F
 23:00 IRS stabilized
 23:05 MRS inlet temperature transient to 152°F. F.C. water flow set to 11
 lb/hr
 23:17 MRS inlet temperature stabilizes at 152°F
 23:35 Test point completion
 MRS inlet temperature transient to 113.4°F
 F.C. water flow set to 7.1 lb/hr
 23:45 MRS inlet temperature stabilizes at 113.4°F
 23:50 F.E. outlet temperature excursion to 36.6°F, then climbs to 40°F

1 May 1973 (day 121)

00:15 Visual observation of exhaust flow attempted: None visible.
 00:55 Test point completion
 MRS inlet temperature transient to 68°F
 F.C. water flow set to 2.50 lb/hr
 01:08 MRS inlet temperature stabilizes at 68°F
 01:24 MRS outlet stabilizes at 42°F
 No F.E. flow
 02:00 Test point completion
 MRS inlet temperature transient to 52.3°F
 F.C. water flow set to .9 lb/hr
 02:13 MRS inlet temperature stabilizes at 52.3°F
 02:45 ACE down to load DAX program; IRS gets full power
 03:09 Test point completion although IRS zones not stable
 Initiate IRS zone power to get 130 BTU/hr/ft²
 03:50 IRS zones stable at 130 BTU/hr/ft²
 04:30 Test point completion
 MRS inlet temperature transient to 69.7°F

04:49 F.C. water flow set to 3 lb/hr
Water tank at 84 lbs.

05:03 MRS set point to 50°F

05:07 No water to evaporator (water line frozen). Water line heater set to 90°F. MRS inlet temperature set to 100°F, and set point changed to 70°F to prepare for flow initiation

06:15 Water line thaws, flow rate to evaporator goes to 40 lb/hr momentarily.

06:15-12:07 After water line thaws, the evaporator floods causing ice to form in the F.C. Sequence to de-ice F.E. and checkout its operation performed

12:25 Test continuation
MRS inlet temperature stable at 69°F. F.C. water flow at 2.5 lb/hr
Duct temperature (AK0013) reads bad.

13:04 MRS set point to 50°F

13:07 F.E. starts spraying
Outlet temperature oscillation : 40.2 to 42.2°F

13:19 MRS set point to 40°F

13:26 MRS set point to 50°F

13:39 MRS set point to 40°F

13:46 MRS set point to 50°F

14:00 MRS set point to 40°F

14:08 MRS set point to 50°F

14:10 Test point completion
MRS inlet temperature transient to 52°F
F.C. water flow rate set to 1 lb/hr
IRS zone transient to 25 BTU/hr/ft²

14:22 MRS inlet temperature stable at 52°F

14:24 MRS set point to 40°F

14:39 MRS set point to 50°F

14:48 MRS set point to 40°F

15:05 MRS set point to 50°F

15:11 MRS set point to 40°F

15:27 MRS set point to 50°F

15:33 MRS set point to 40°F

15:49 MRS set point to 50°F

16:00 MRS set point to 40°F

16:10 IRS zones stabilize

16:13 MRS set point to 50°F
 16:20 MRS set point to 40°F
 16:35 MRS set point to 50°F
 16:43 MRS set point to 40°F
 16:58 MRS set point to 50°F
 17:06 MRS set point to 40°F
 17:16 F.C. water flow rate set to 20 lb/hr to prepare for inlet
 temperature ramp
 17:18 MRS set point to 50°F
 17:57 MRS set point to 70°F
 MRS inlet temperature ramp to 85°F initiated
 Water tank at 95 lbs
 Two MRS panels have frozen tubes
 18:14 Water tank at 97.2 lbs
 18:21 Water tank at 97.6 lbs
 18:28 Water tank at 98.0 lbs
 18:37 PE-6 pressure reads for first time during test
 18:38 F.E. goes full on
 18:45 Water tank at 97.6 lbs
 18:50 Water tank pressure increased from 31.6 to 34.4 psi to
 get 16 lb/hr flow rate
 18:53 MRS outlet at 70°F
 18:58 Water tank quantity manually reduced to 83 lbs
 MRS set point to 40°F
 19:00 F.E. outlet during transient from 70°F set point to 40°F
 set point ranges from 37.5 to 42.4
 19:17 Test point completion
 MRS inlet temperature set to 122°F
 F.C. water flow set to 8 lb/hr
 19:24 MRS inlet temperature stabilizes at 122°F
 19:37 MRS set point to 50°F
 20:21 IRS stabilizes, environment cycling initiated
 20:30 Clock started for mission simulation
 22:05 MRS inlet temperature set to 166°F
 F.C. water flow set to 12.5 lb/hr
 22:35 MRS set point to 70°F

22:40 Water tank pressure increased to 36.2 psi to get 16.0 lb/hr
22:46 MRS inlet temperature set to 115.2°F
F.C. water flow set to 7.3 lb/hr
23:12 F.C. water supply tank goes empty
23:23 F.C. water supply tank filled.

2 May 1973 (day 122)

00:00 MRS inlet temperature set to 147.4°F
F.C. water flow set to 10.5 lb/hr
00:13 MRS set point to 40°F
Water quantity is 85.4 lbs.
00:18 MRS set point to 50°F
01:00 MRS inlet temperature set to 115.2°F
F.C. water flow set to 7.3 lb/hr
01:45 MRS inlet temperature set to 104.3°F
F.C. water flow set to 6.2 lb/hr
02:30 MRS inlet temperature set to 115°F
F.C. water flow set to 7.3 lb/hr
04:00 MRS inlet temperature set to 104.3°F
F.C. water flow set to 6.2 lb/hr
05:00 MRS inlet temperature set to 149.2°F
F.C. water flow to 10.7 lb/hr
06:03 Nozzle heater turned off
(Temperatures were 63 to 69°F)
06:24 MRS set point changed manually to 70°F
07:00 Duct heater turned off
07:00 IRS zones set to 136 BTU/hr/ft²
08:40 FE internal pressure starts rising
09:40 MRS inlet temperature set to 100°F
09:51 Nozzle heaters turned on to see if nozzle or duct is icing up
09:52-09:57 MRS mix temperature drops below 70°F
10:00 FE internal pressure has excursion to 7.0 min. Turned FE spray off.
10:03 Turned FE duct heater back on
10:07 Turned FE spray back on
FE pressure returns to normal operating pressure (3.5 to 3.6 mm)
10:30 Flash Evaporator test complete
Begin FE post ops

11:00 FE post ops complete
 11:26 Freon flow initiated to sublimator
 12:28 All valves configured for sublimator operation
 12:45 Aces update, no data available
 to
 14:15
 14:15-15:15 IRS pumps out
 15:25 Water flow to sublimator initiated
 15:34 Water flow to sublimator stops
 15:46-24:00 Frozen water line in sublimator package. MRS configured
 to give 140°F fluid to sublimator to thaw water line.

3 May 1973 (Day 123)

00:00-13:15 Thawed water line, established flow, purged water line
 with air.
 13:38 Ice layer formed in sublimator
 13:47 MRS to 40°F set point using HSD controller
 13:50 Start clock
 14:03 MRS set point to 70°F
 14:04 IRS approaching 135 BTU/hr/ft²
 FC water flow set to 10 lb/hr
 14:23 FC water flow set to 1 lb/hr
 14:27 IRS zones stabilize
 14:30 Water tank at 92.5 lbs.
 14:58 MRS set point to 40°F
 15:09 MRS inlet temperature set to 106°F
 FC water flow set at 6.7 lb/hr
 15:10 Water tank at 84 lbs
 FC water flow set to 3.2 lb/hr
 16:00 Sublimator loses water flow
 16:05 MRS outlet manually set to 60°F to reestablish flow
 16:08 Sublimator water flow is established
 16:12 Sublimator water flow is 13 lb/hr
 16:18 MRS outlet reset to 42°F with controller operating
 16:33 MRS inlet temperature set to 51°F
 16:38 MRS inlet temperature set to 46°F
 16:42 Sublimator loses water flow

16:47 MRS outlet temperature manually set to 52°F
 to re-establish flow
 16:54 Sublimator water flow starts again. Flow is 9.6 lb/hr
 16:56 MRS outlet temperature reset to 40.6°F
 17:30 IRS zone set to 60 BTU/hr/ft²
 17:57 Sublimator water flow stops, MRS outlet manually set to 50.0°F
 to help re-establish flow
 18:00 Sublimator water flow starts. Flow is 9.4 lb/hr. IRS zones stable
 18:02 MRS outlet returned to 40°F with excursion to 32°F (less than
 1 minute)
 18:05 MRS set point raised to 44.8
 19:23 Sublimator water flow stops, MRS outlet manually set to 49°F
 19:25 Sublimator water flow starts
 19:30 MRS outlet manually set 42.7°F
 19:36 MRS set point to 70°F
 9:37 MRS inlet temperature ramp to 85°F initiated. Tank quality 94.9 lbs
 20:05 Tank quantity 96.0 lbs
 20:09 Tank quantity 96.4 lbs
 20:13 Tank quantity 96.4 lbs
 20:20 Tank quantity 96.4 lbs
 20:26 Tank quantity 96.3 lbs
 20:36 MRS outlet temperature reaches 70°F
 20:46 MRS inlet temp ramp reaches 85°F
 21:01 MRS set point to 40°F
 Water tank set to 83 lbs
 21:15 MRS inlet temp set to 118°F
 F.C. water flow set to 8.2 lb/hr
 21:39 F.C. water flow set to 12 lb/hr
 22:15 MRS inlet temp set to 165°F, F.C. water set to 16.5 lb/hr (This
 was done to peak water tank quantity to change set points faster.
 23:00 MRS inlet temp set to 53°F
 F.C. water set to 5 lb/hr
 23:58 Sublimator loses water flow. MRS outlet temp manually set to
 50°F to re-establish flow. Flow re-established at 7 lb/hr

4 May 1974 (day 124)

00:03 MRS inlet temp set to 145°F
F.C. water flow set to 10.5 lb/hr

00:06 MRS set point to 70°F. (Accomplished manually)

00:33 Switched to LTV ATM controller from HSD controller for test duration to achieve better control.

00:35 MRS inlet temp set to 98°F
F.C. water flow set to 1.5 lb/hr

00:40 HPE requests return to 40°F set point because of breakthrough

00:40 Sublimator has breakthrough

00:48
to Re-establish sublimator operation

2:52

3:03 MRS inlet set to 145°F

3:10 MRS set point manually set 70°F

3:30 MRS inlet set to 98°F

4:10 MRS set point manually set to 40°F to simulate run down of water tank

4:33 MRS set point set to 50°F to get sublimator to safe condition during ACES update

4:48 MRS inlet temp set to 147°F

4:58 Nozzle heaters turned off

5:03 MRS set point reduced to 65°F to prevent breakthrough

5:11 MRS set point reduced to 60°F to prevent breakthrough (Sublimator outlet up to 44°F)

6:00 Duct heater turned off

6:32 MRS set point to 65°F

6:34 MRS set point to 60°F because sublimator outlet at 44°F

10:00 Sublimator outlet goes from 45.3 to 54.4°F indicating breakthrough

10:30 End Test

APPENDIX III: COMPLETE TEST DATA PLOTS

The test data presented in this appendix is grouped into time periods as follows:

TABLE III-1

| GROUP | TEST TIMES(day, time) | | TEST POINTS |
|-------|-----------------------|------------|---------------|
| | FROM | TO | |
| A | 120 - 1830 | 121 - 0500 | 1 through 7 |
| B | 121 - 1300 | 122 - 0030 | 8 through 14 |
| C | 122 - 0030 | 122 - 1100 | 15 through 23 |
| D | 123 - 1400 | 124 - 0500 | 24 through 36 |

Each of the above groups is further subdivided by type of measurement as shown below:

- o MRS flowrates and pressure measurements-see Table III-2
- o MRS panel and system inlet and outlet temperatures-see Table III-3
- o Radiator panel surface temperatures-see Table III-4 and Figure III-1
- o Evaporator, sublimator and water system data-see Table III-5 and Figure III-2

TABLE III-2

PLOTTED FLOWS AND PRESSURE DROPS

| PAGE* | TRANSDUCER NUMBER | DESCRIPTION | UNITS |
|-------|----------------------|--------------------------------|-------|
| 1 | FM0040 | TOTAL FLOW | LBPH |
| | FM0043 | TOTAL PRIME FLOW HIGH RANGE | LBPH |
| | FM0046 | TOTAL BANK FLOW HIGH RANGE | LBPH |
| 2 | FM0041 | TOTAL PRIME FLOW LOW RANGE | LBPH |
| | FM0044 | TOTAL BANK FLOW LOW RANGE | LBPH |
| | FM0047 | PRIME CKT 1 AND 2 LOW RANGE | LBPH |
| | FM0050 | PRIME CKT 3 AND 4 LOW RANGE | LBPH |
| 3 | FM0042 | TOTAL PRIME FLOW INT RANGE | LBPH |
| | FM0045 | TOTAL BANK FLOW INT RANGE | LBPH |
| | FM0048 | PRIME CKT 1 AND 2 INT RANGE | LBPH |
| | FM0051 | PRIME CKT 3 AND 4 INT RANGE | LBPH |
| 4 | FM0049 | PRIME CKT 1 AND 2 HIGH RANGE | LBPH |
| | FM0052 | PRIME CKT 3 AND 4 HIGH RANGE | LBPH |
| 5 | FM0053 | BANK CKT 5 INT RANGE | LBPH |
| | FM0055 | BANK CKT 6 INT RANGE | LBPH |
| | FM0057 | BANK CKT 7 INT RANGE | LBPH |
| | FM0059 | BANK CKT 8 INT RANGE | LBPH |
| 6 | FM0054 | BANK CKT 5 HIGH RANGE | LBPH |
| | FM0056 | BANK CKT 6 HIGH RANGE | LBPH |
| | FM0058 | BANK CKT 7 HIGH RANGE | LBPH |
| | FM0060 | BANK CKT 8 HIGH RANGE | LBPH |
| 7 | PK0066 | BANK PANEL 1 DELTA PRESSURE | PSID |
| | PK0067 | BANK PANEL 2 DELTA PRESSURE | PSID |
| | PK0068 | BANK PANEL 3 DELTA PRESSURE | PSID |
| | PK0069 | BANK PANEL 4 DELTA PRESSURE | PSID |
| 8 | PK0065 | PRIME TUBE MIX OUTLET PRESSURE | PSIG |
| 9 | PK0061 | PRIME CKT 1 INLET PRESSURE | PSIG |
| | PK0062 | PRIME CKT 2 INLET PRESSURE | PSIG |
| | PK0063 | PRIME CKT 3 INLET PRESSURE | PSIG |
| | PK0064 | PRIME CKT 4 INLET PRESSURE | PSIG |
| 10 | PK0070 | BANK PANEL 5 DELTA PRESSURE | PSID |
| | PK0071 | BANK PANEL 6 DELTA PRESSURE | PSID |
| | PK0072 | BANK PANEL 7 DELTA PRESSURE | PSID |
| | PK0073 | BANK PANEL 8 DELTA PRESSURE | PSID |

*Page numbers are preceeded by a letter
as shown in Table III-1

denoting the grouping

TABLE III-3

PLOTTED SYSTEM AND PANEL INLET AND OUTLET TEMPERATURES

| PAGE | T/C NO | DESCRIPTION | UNITS |
|------|--------|--------------------------------|-------|
| 11 | AI0037 | BANK TUBES INLET TO MIX VALVE | DEG F |
| | AI0038 | PRIME TUBES INLET TO MIX VALVE | DEG F |
| 12 | AJ0037 | BANK TUBES INLET TO MIX VALVE | DEG F |
| | AJ0038 | PRIME TUBES INLET TO MIX VALVE | DEG F |
| 13 | AJ0001 | PRIME SYSTEM INLET | DEG F |
| 14 | AJ0002 | BANK SYSTEM INLET | DEG F |
| 15 | AI0019 | PRIME TUBES OUTLET MIX IN CH | DEG F |
| | AI0036 | BANK TUBES OUTLET MIX IN CH | DEG F |
| | AI0039 | MIXED BANK AND PRIME | DEG F |
| 16 | AJ0019 | PRIME TUBES OUTLET MIX IN CH | DEG F |
| | AJ0036 | BANK TUBES OUTLET MIX IN CH | DEG F |
| | AJ0039 | MIXED BANK AND PRIME | DEG F |
| 17 | AI0003 | PANEL NO 1 PRIME TUBE INLET | DEG F |
| | AI0004 | PANEL NO 2 PRIME TUBE INLET | DEG F |
| | AI0005 | PANEL NO 5 PRIME TUBE INLET | DEG F |
| | AI0006 | PANEL NO 6 PRIME TUBE INLET | DEG F |
| 18 | AJ0003 | PANEL NO 1 PRIME TUBE INLET | DEG F |
| | AJ0004 | PANEL NO 2 PRIME TUBE INLET | DEG F |
| | AJ0005 | PANEL NO 5 PRIME TUBE INLET | DEG F |
| | AJ0006 | PANEL NO 6 PRIME TUBE INLET | DEG F |
| 19 | AI0007 | PANEL NO 1 PRIME TUBE OUTLET | DEG F |
| | AI0008 | PANEL NO 2 PRIME TUBE OUTLET | DEG F |
| | AI0009 | PANEL NO 5 PRIME TUBE OUTLET | DEG F |
| | AI0010 | PANEL NO 6 PRIME TUBE OUTLET | DEG F |
| 20 | AJ0007 | PANEL NO 1 PRIME TUBE OUTLET | DEG F |
| | AJ0008 | PANEL NO 2 PRIME TUBE OUTLET | DEG F |
| | AJ0009 | PANEL NO 5 PRIME TUBE OUTLET | DEG F |
| | AJ0010 | PANEL NO 6 PRIME TUBE OUTLET | DEG F |
| 21 | AI0011 | PANEL NO 3 PRIME TUBE INLET | DEG F |
| | AI0012 | PANEL NO 4 PRIME TUBE INLET | DEG F |
| | AI0013 | PANEL NO 7 PRIME TUBE INLET | DEG F |
| | AI0014 | PANEL NO 8 PRIME TUBE INLET | DEG F |
| 22 | AJ0011 | PANEL NO 3 PRIME TUBE INLET | DEG F |
| | AJ0012 | PANEL NO 4 PRIME TUBE INLET | DEG F |
| | AJ0013 | PANEL NO 7 PRIME TUBE INLET | DEG F |
| | AJ0014 | PANEL NO 8 PRIME TUBE INLET | DEG F |

TABLE III-3 (Continued)

| PAGE | T/C NO | DESCRIPTION | UNITS |
|------|--------|------------------------------|-------|
| 23 | AI0015 | PANEL NO 3 PRIME TUBE OUTLET | DEG F |
| | AI0016 | PANEL NO 4 PRIME TUBE OUTLET | DEG F |
| | AI0017 | PANEL NO 7 PRIME TUBE OUTLET | DEG F |
| | AI0018 | PANEL NO 8 PRIME TUBE OUTLET | DEG F |
| 24 | AJ0015 | PANEL NO 3 PRIME TUBE OUTLET | DEG F |
| | AJ0016 | PANEL NO 4 PRIME TUBE OUTLET | DEG F |
| | AJ0017 | PANEL NO 7 PRIME TUBE OUTLET | DEG F |
| | AJ0018 | PANEL NO 8 PRIME TUBE OUTLET | DEG F |
| 25 | AI0020 | PANEL NO 1 BANK TUBE INLET | DEG F |
| | AI0021 | PANEL NO 2 BANK TUBE INLET | DEG F |
| | AI0022 | PANEL NO 5 BANK TUBE INLET | DEG F |
| | AI0023 | PANEL NO 6 BANK TUBE INLET | DEG F |
| 26 | AJ0020 | PANEL NO 1 BANK TUBE INLET | DEG F |
| | AJ0021 | PANEL NO 2 BANK TUBE INLET | DEG F |
| | AJ0022 | PANEL NO 5 BANK TUBE INLET | DEG F |
| | AJ0023 | PANEL NO 6 BANK TUBE INLET | DEG F |
| 27 | AI0024 | PANEL NO 1 BANK TUBE OUTLET | DEG F |
| | AI0025 | PANEL NO 2 BANK TUBE OUTLET | DEG F |
| | AI0026 | PANEL NO 5 BANK TUBE OUTLET | DEG F |
| | AI0027 | PANEL NO 6 BANK TUBE OUTLET | DEG F |
| 28 | AJ0024 | PANEL NO 1 BANK TUBE OUTLET | DEG F |
| | AJ0025 | PANEL NO 2 BANK TUBE OUTLET | DEG F |
| | AJ0026 | PANEL NO 5 BANK TUBE OUTLET | DEG F |
| | AJ0027 | PANEL NO 6 BANK TUBE OUTLET | DEG F |
| 29 | AI0028 | PANEL NO 3 BANK TUBE INLET | DEG F |
| | AI0029 | PANEL NO 4 BANK TUBE INLET | DEG F |
| | AI0030 | PANEL NO 7 BANK TUBE INLET | DEG F |
| | AI0031 | PANEL NO 8 BANK TUBE INLET | DEG F |
| 30 | AJ0028 | PANEL NO 3 BANK TUBE INLET | DEG F |
| | AJ0029 | PANEL NO 4 BANK TUBE INLET | DEG F |
| | AJ0030 | PANEL NO 7 BANK TUBE INLET | DEG F |
| | AJ0031 | PANEL NO 8 BANK TUBE INLET | DEG F |
| 31 | AI0032 | PANEL NO 3 BANK TUBE OUTLET | DEG F |
| | AI0033 | PANEL NO 4 BANK TUBE OUTLET | DEG F |
| | AI0034 | PANEL NO 7 BANK TUBE OUTLET | DEG F |
| | AI0035 | PANEL NO 8 BANK TUBE OUTLET | DEG F |
| 32 | AJ0032 | PANEL NO 3 BANK TUBE OUTLET | DEG F |
| | AJ0033 | PANEL NO 4 BANK TUBE OUTLET | DEG F |
| | AJ0034 | PANEL NO 7 BANK TUBE OUTLET | DEG F |
| | AJ0035 | PANEL NO 8 BANK TUBE OUTLET | DEG F |

TABLE III-4

ORGANIZATION OF ON-PANEL TEMPERATURE DATA

DATA FROM: IS IN THE 14 PAGE GROUP NUMBERED:*

Panel 1 33 through 46
 Panel 2 47 through 60
 Panel 3 61 through 74
 Panel 4 75 through 88
 Panel 5 89 through 102
 Panel 6 103 through 116
 Panel 7 117 through 130
 Panel 8 131 through 144

EACH 14-PAGE PANEL GROUP IS ORGANIZED AS FOLLOWS

| PAGE | * T/C LOCATIONS (see Figure 1) | DESCRIPTION |
|------|-----------------------------------|------------------------------------|
| 1st | 1, 2, 3, 4 | Bank outlet temperatures |
| 2nd | 5, 6, 7, 8 | Bank outlet temperatures |
| 3rd | 9, 10, 12, 13 | Bank and prime outlet temperatures |
| 4th | 14, 17, 19, 20 | Bank and prime inlet temperatures |
| 5th | 21, 22, 23, 24 | Bank inlet temperatures |
| 6th | 25, 26, 27, 28 | Bank inlet temperatures |
| 7th | 12, 15, 16, 17 | Temperatures along 2nd tube |
| 8th | 9, 30, 20 | Temperatures along 4th tube |
| 9th | 5, 21, 36, 24 | Temperatures along 8th tube |
| 10th | 3, 32, 38, 26 | Temperatures along 10th tube |
| 11th | 1, 33, 34, 38 | Temperatures along 12th tube |
| 12th | 30, 31, 32, 35 | Temperatures along diagonal |
| 13th | 34, 35, 36 | Temperatures along median |
| 14th | 11, 18, 29 | Temperatures on manifold |

* Page numbers are preceded by a letter denoting the grouping shown in Table III-1

TABLE III-5
EVAPORATOR, SUBLIMATOR, WATER SYSTEM DATA

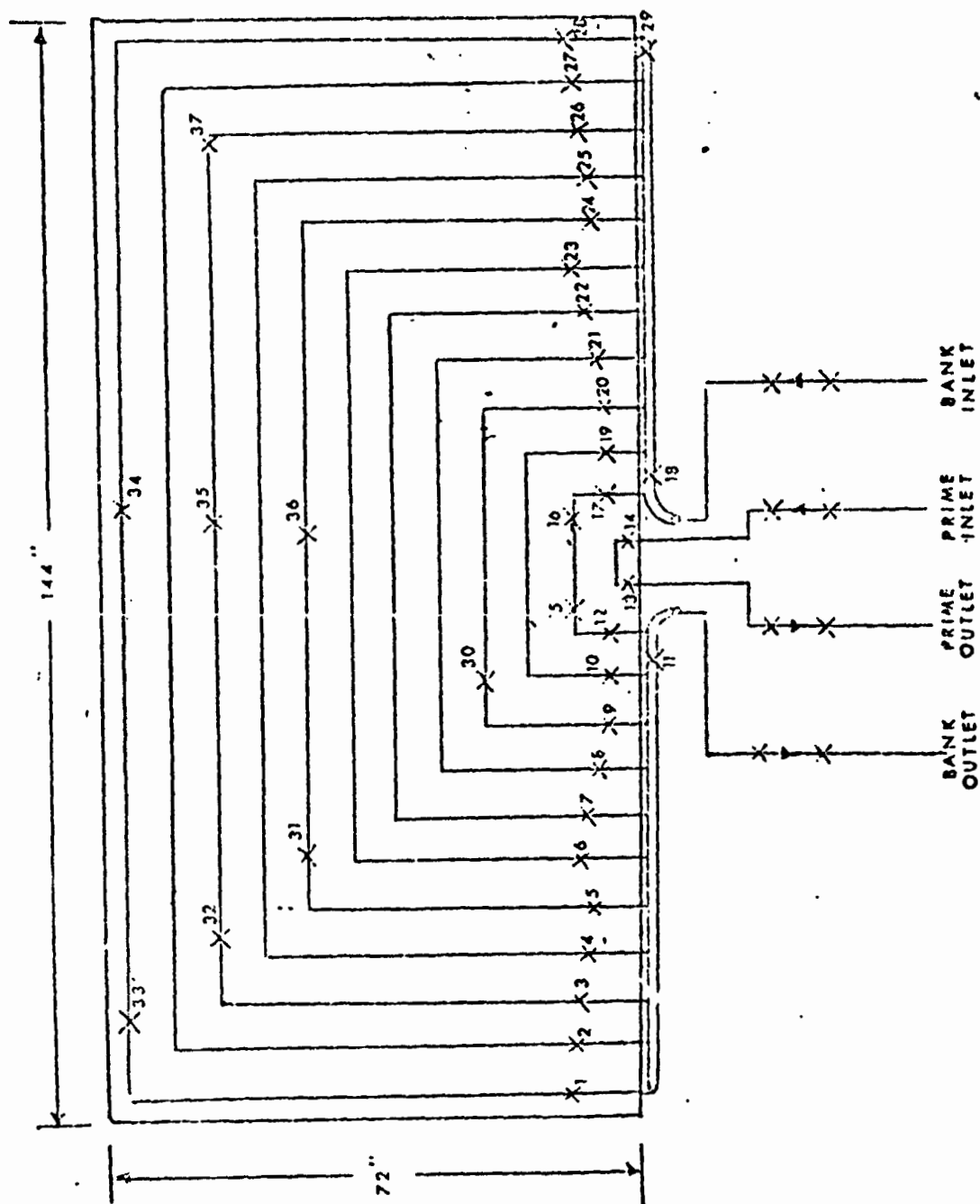
| GROUPS A, B, C PAGE * | TRANSDUCER NUMBER | DESCRIPTION | UNITS |
|-----------------------------|----------------------|---------------------------------------|-------|
| 145 | AK0001 | EVAP PRI F21 INLET TEMP NO 1 | DEG F |
| | AK0002 | EVAP PRI F21 INLET TEMP NO 2 | DEG F |
| | AK0003 | EVAP PRI F21 OUTLET TEMP NO 1 | DEG F |
| | AK0004 | EVAP PRI F21 OUTLET TEMP NO 2 | DEG F |
| 146 | AK0005 | EVAP SEC F21 INLET TEMP NO 1 | DEG F |
| | AK0006 | EVAP SEC F21 INLET TEMP NO 2 | DEG F |
| | AK0007 | EVAP SEC F21 OUTLET TEMP NO 1 | DEG F |
| | AK0008 | EVAP SEC F21 OUTLET TEMP NO 2 | DEG F |
| 147 | AK0013 | EVAP SEC F21 DUCT INLET TEMP | DEG F |
| | AK0005 | EVAP SEC F21 INLET NO 1 | DEG F |
| | AK0006 | EVAP SEC F21 INLET NO 2 | DEG F |
| 148 | AK0011 | EVAP EXHAUST DUCT INLET TEMP | DEG F |
| | AK0012 | EVAP EXHAUST DUCT DISCH TEMP | DEG F |
| | AK1001 | EVAP NOZZLE THROAT TEMP NO 1 | DEG F |
| | AK1002 | EVAP NOZZLE THROAT TEMP NO 2 | DEG F |
| 149 | AK1003 | EVAP NOZZLE CHAMBER TEMP 1 | DEG F |
| | AK1004 | EVAP NOZZLE CHAMBER TEMP 2 | DEG F |
| | AK1005 | EVAP NOZZLE CHAMBER TEMP 3 | DEG F |
| | AK1006 | EVAP NOZZLE CHAMBER TEMP 4 | DEG F |
| 150 | PE0001 | EVAP CHAMBER PRESSURE | TORR |
| | PE0001 | EVAP CHAMBER PRESSURE | TORR |
| 151 | PE0006 | EVAP EXHAUST DUCT INLET PRESSURE | TORR |
| | PE0007 | EVAP EXHAUST DUCT OUTLET PRESSURE | TORR |
| | PE1001 | EVAP NOZZLE CHAMBER PRESSURE | TORR |
| 152 | PE0004 | EVAP F21 DELTA PRESSURE, PRI | PSID |
| | PE0005 | EVAP F21 DELTA PRESSURE, SEC | PSID |
| 153 | PE0008 | EVAP H ₂ O TANK PRESSURE | PSIA |
| 154 | PE0106 | EVAP EXHAUST DUCT INLET PR RG WD | TORR |
| | PE0107 | EVAP EXHAUST DUCT OUTLET PR RG WD | TORR |
| | PE1101 | EVAP NOZZLE CHAMBER PR RG WD | TORR |
| 155 | LK0001 | EVAP H ₂ O TANK QUANTITY | LB |
| 156 | FW0001 | H ₂ O FLOW INTO TANK | LBPH |
| | FW0002 | H ₂ O FLOW TO EVAP OR SUBL | LBPH |

* Page numbers are preceeded by a letter
grouping shown in Table III-1

TABLE III-5(cont)
EVAPORATOR, SUBLIMATOR, WATER SYSTEM DATA

| GROUP D PAGE | TRANSDUCER NUMBER | DESCRIPTION | UNITS |
|-----------------|----------------------|-----------------------------------|-------|
| 145 | AL0001 | SUBL F21 INLET TEMP NO 1 | DEG F |
| | AL0002 | SUBL F21 INLET TEMP NO 2 | DEG F |
| | AL0003 | SUBL F21 OUTLET TEMP NO 1 | DEG F |
| | AL0004 | SUBL F21 OUTLET TEMP NO 2 | DEG F |
| 146 | AL0005 | SUBL F21 DUCT INLET TEMP | DEG F |
| | AL0001 | SUBL F21 INLET TEMP NO 1 | DEG F |
| | AL0002 | SUBL F21 INLET TEMP NO 2 | DEG F |
| 147 | AL0008 | SUBL EXHAUST DUCT INLET TEMP | DEG F |
| | AL0009 | SUBL EXHAUST DUCT DISCH TEMP | DEG F |
| | AL1001 | SUBL NOZZLE THROAT TEMP NO 1 | DEG F |
| | AL1002 | SUBL NOZZLE THROAT TEMP NO 2 | DEG F |
| 148 | AL0006 | SUBL H2O SUPPLY TEMP | DEG F |
| 149 | PS0001 | SUBL H2O SUPPLY INLET PRESSURE | PSIA |
| 150 | PS0002 | SUBL EXHAUST DUCT INLET PRESSURE | TORR |
| | PS0003 | SUBL EXHAUST DUCT OUTLET PRESSURE | TORR |
| | PS1001 | SUBL NOZZLE CHAMBER PRESSURE | TORR |
| 151 | FW0001 | H2O FLOW INTO TANK | LBPH |
| | FW0002 | H2O FLOW TO SUBLIMATOR | LBPH |

FIGURE III-1
THERMOCOUPLE LOCATIONS



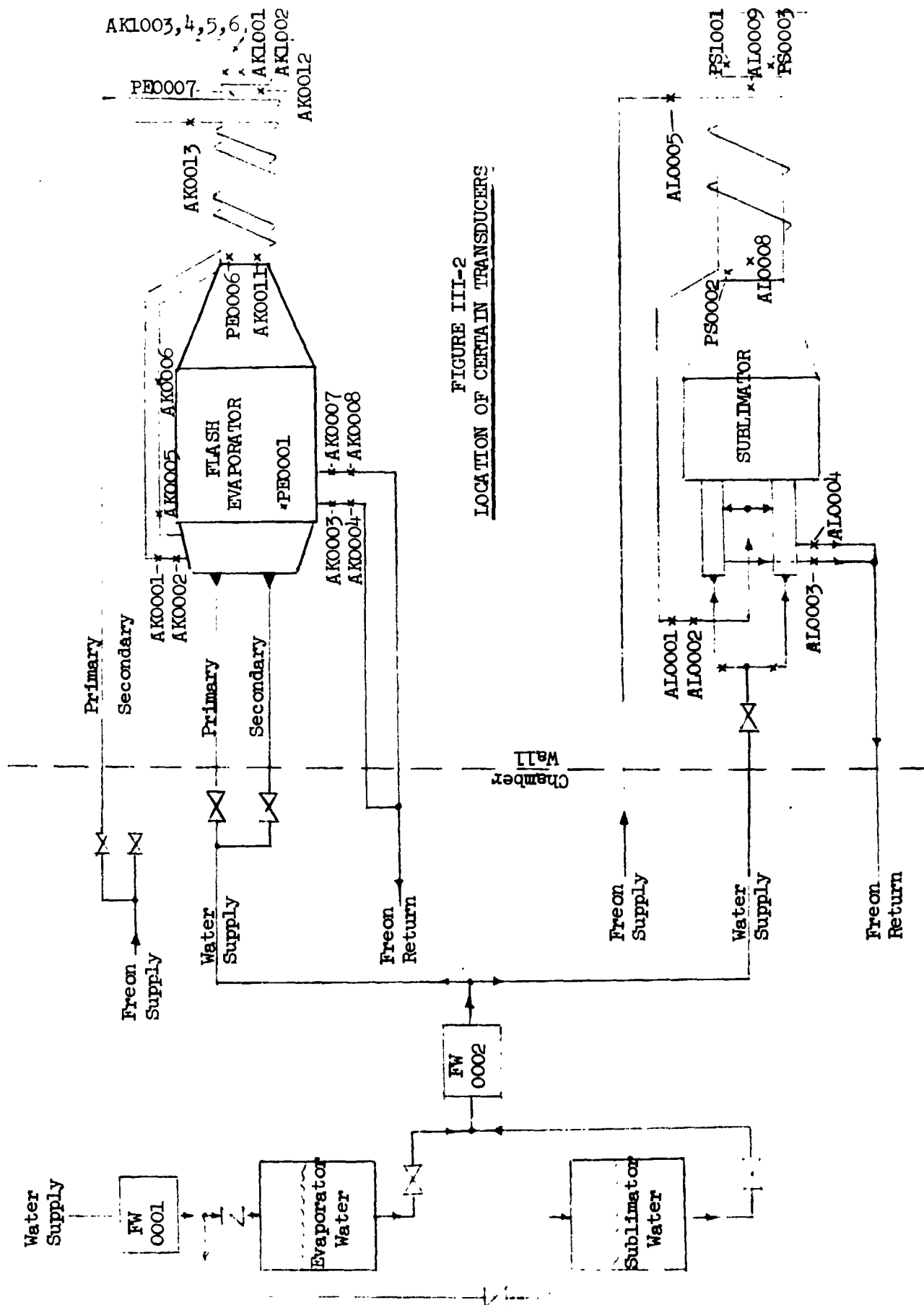
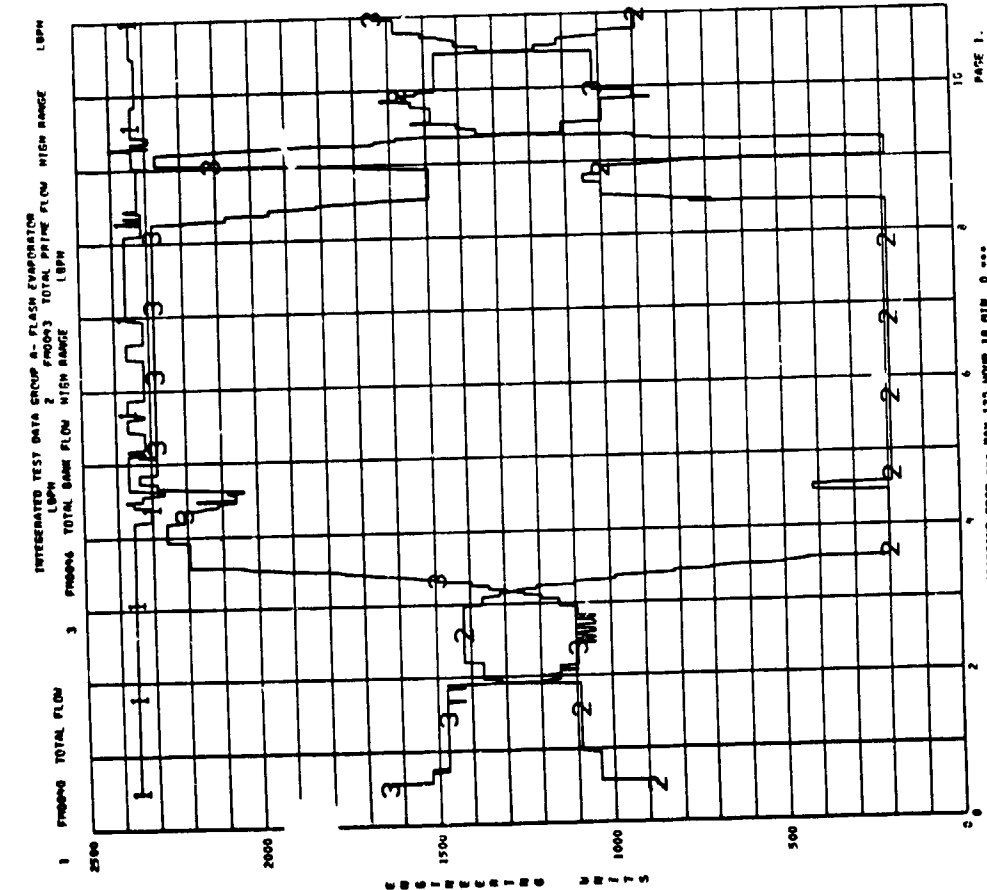


FIGURE III-2
LOCATION OF CERTAIN TRANSDUCERS

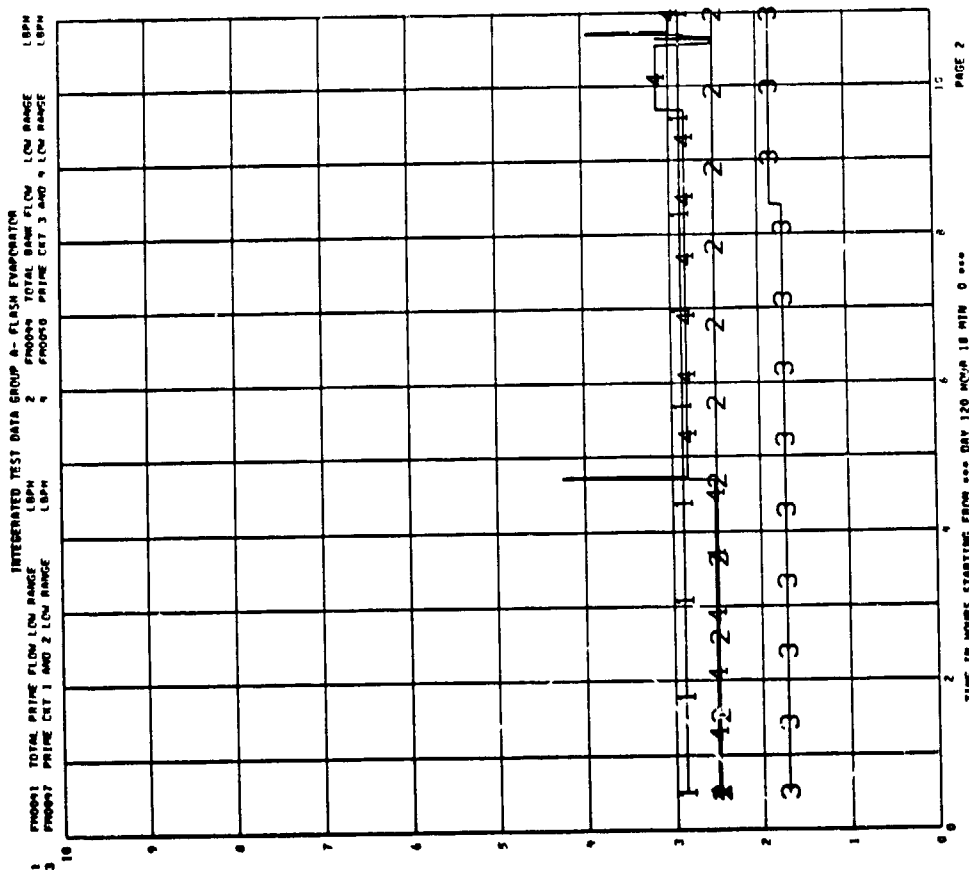
DATA GROUP A

TEST POINTS 1-7

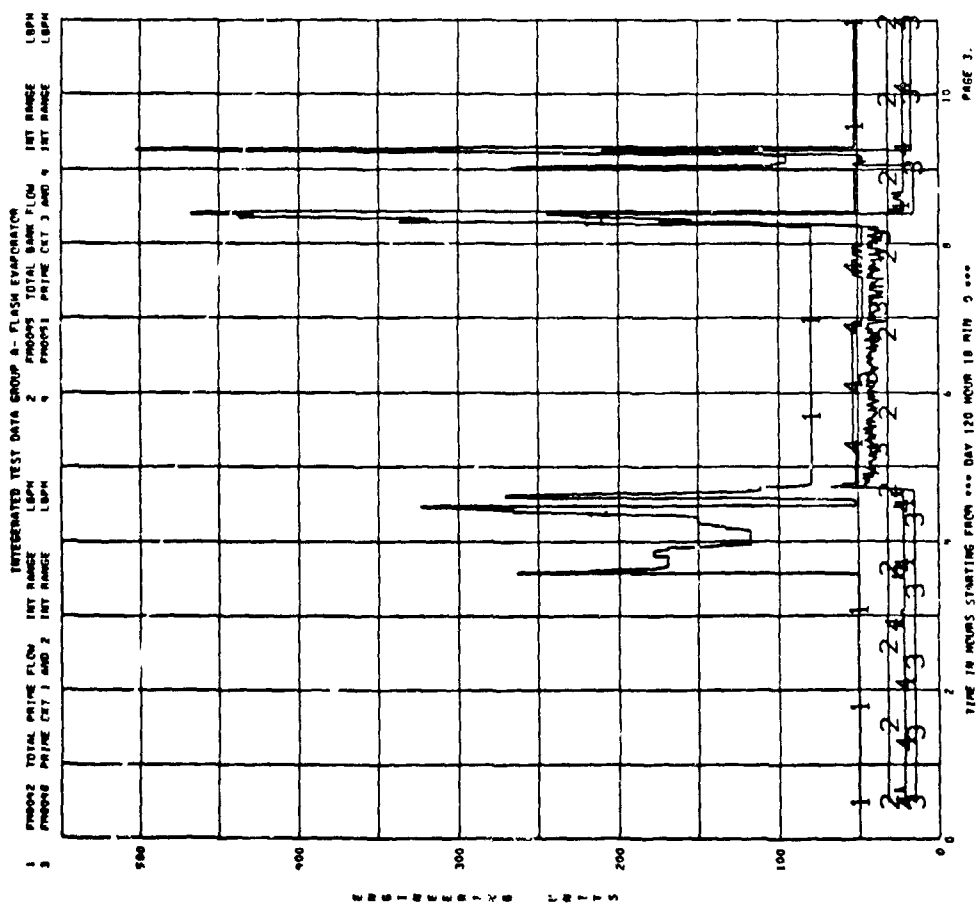
From Day 120, 1830 to Day 121, 0500



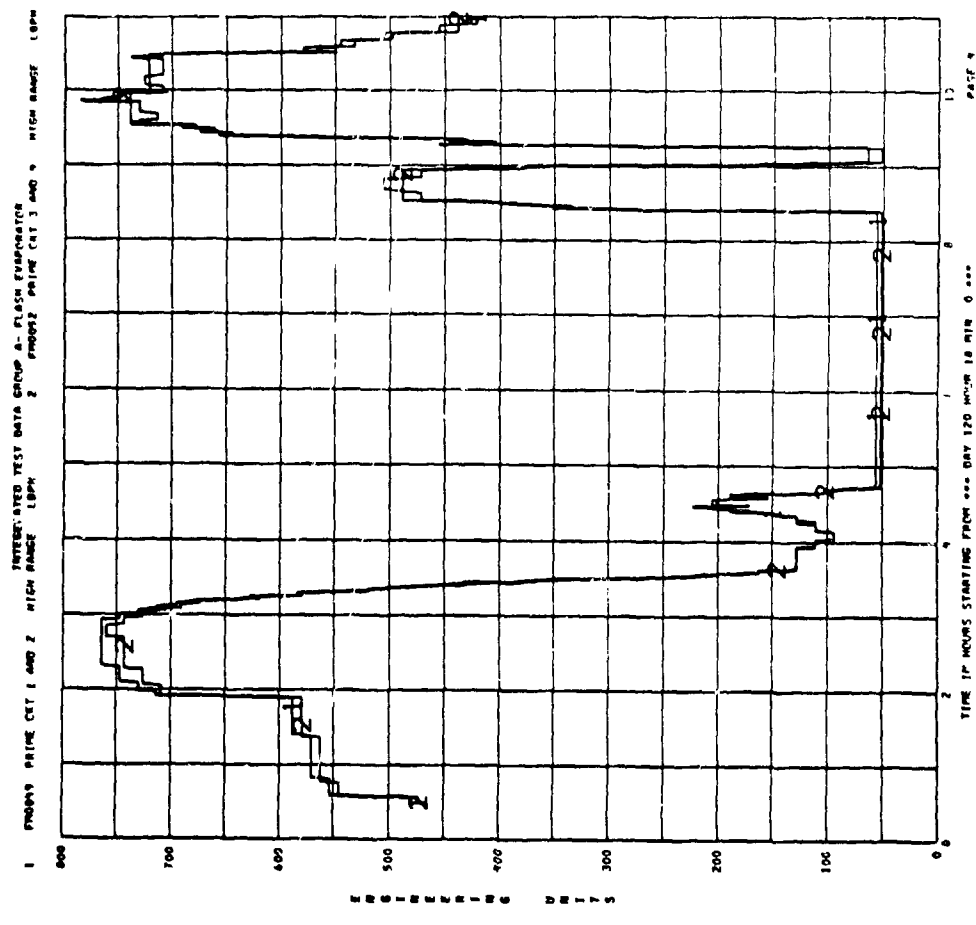
A-1



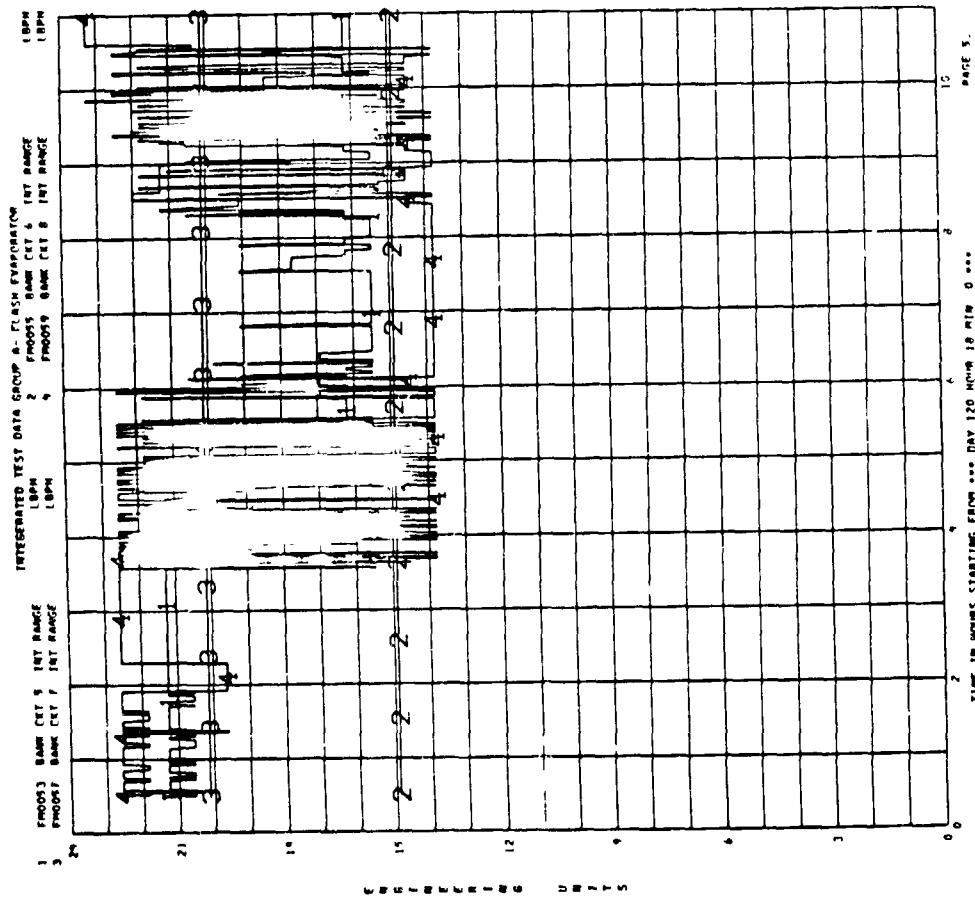
A-2



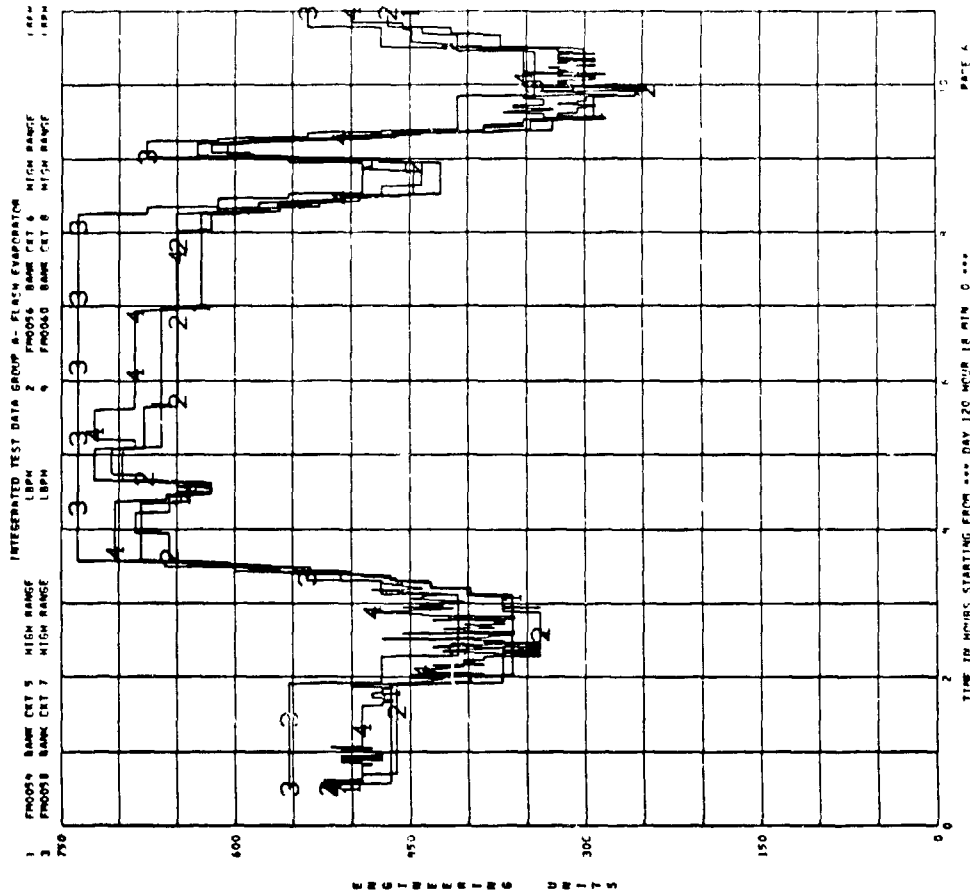
A-3



A-4

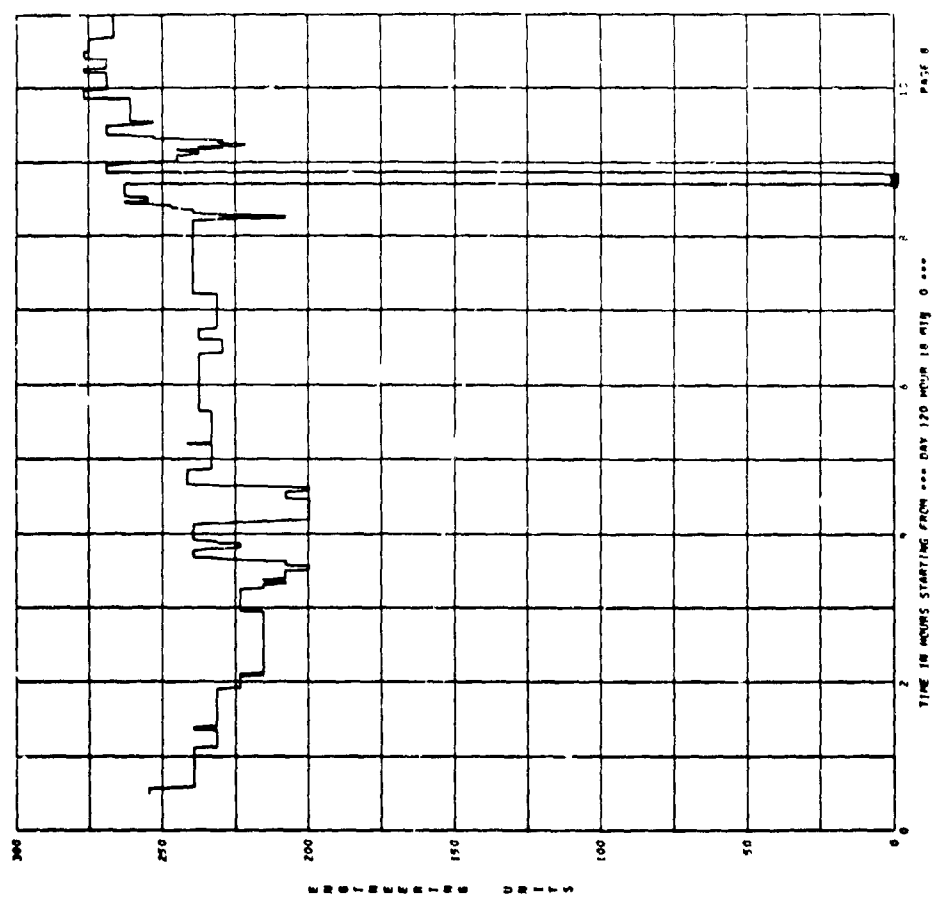


A-5



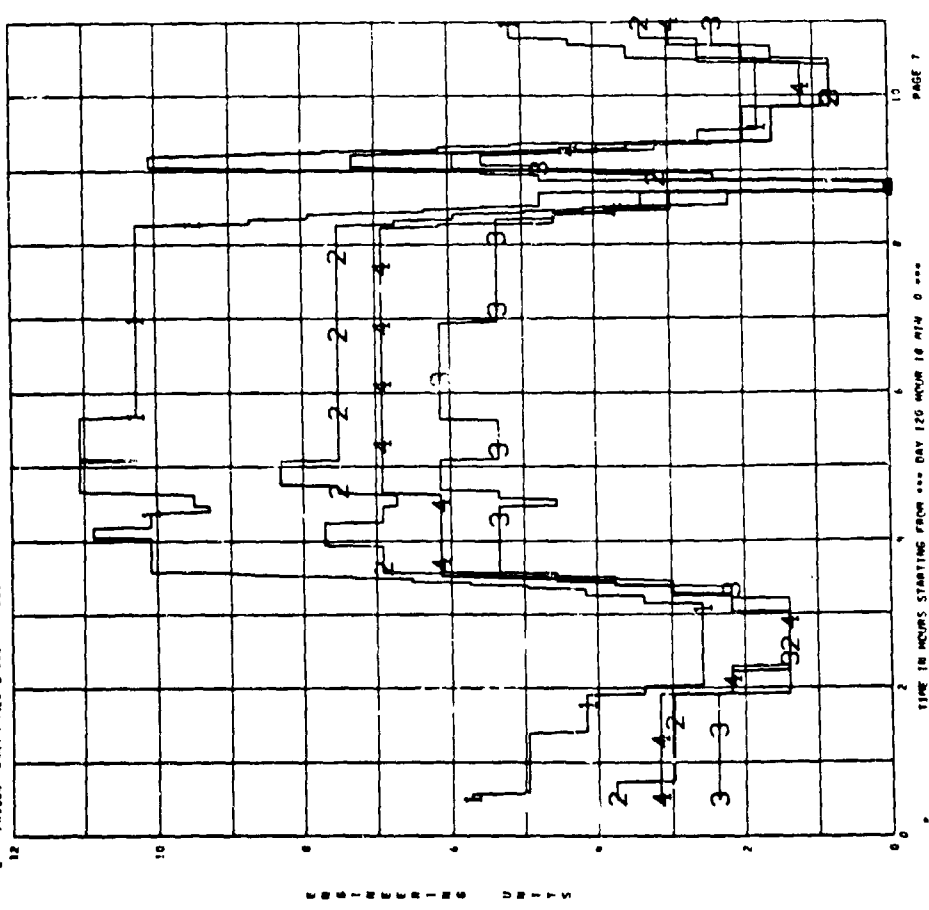
A-6

INTERMEDIATE TEST DATA GROUP A- FLASH EVAPORATION
1 PROBES PRIME TUBE MIX OUTLET PRESSURE PSIG

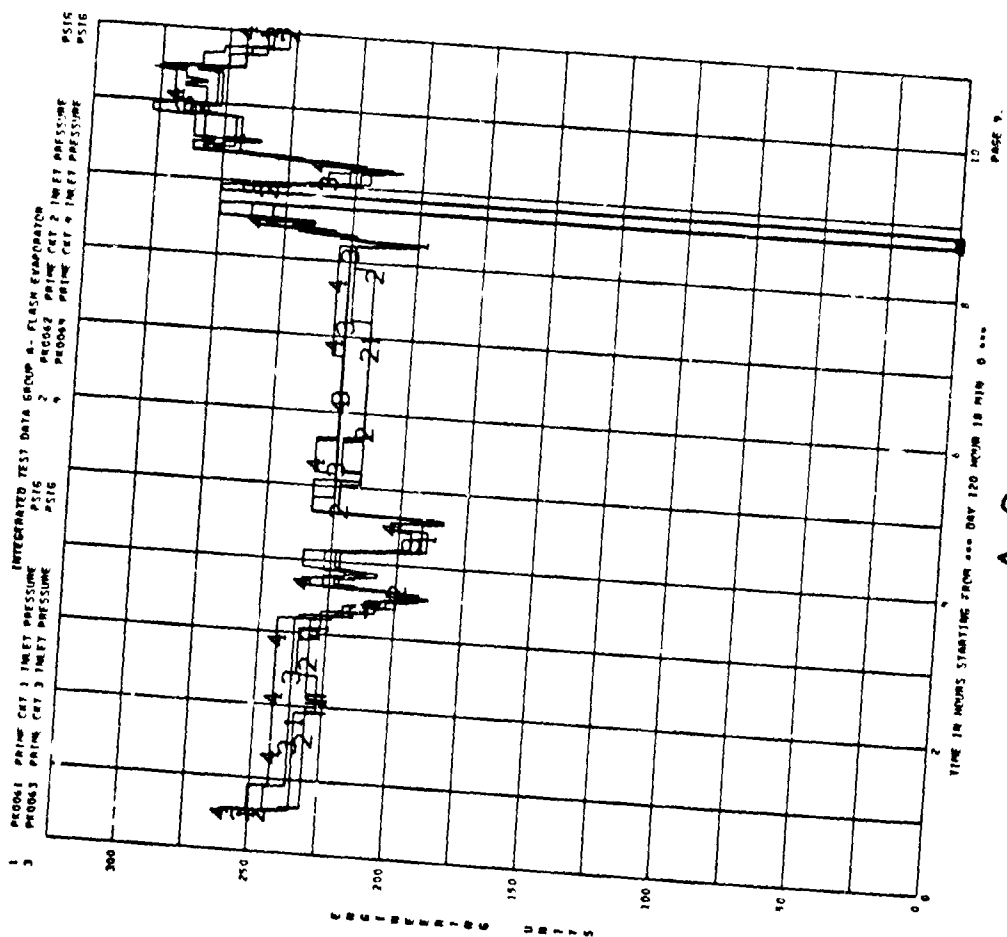


A-8

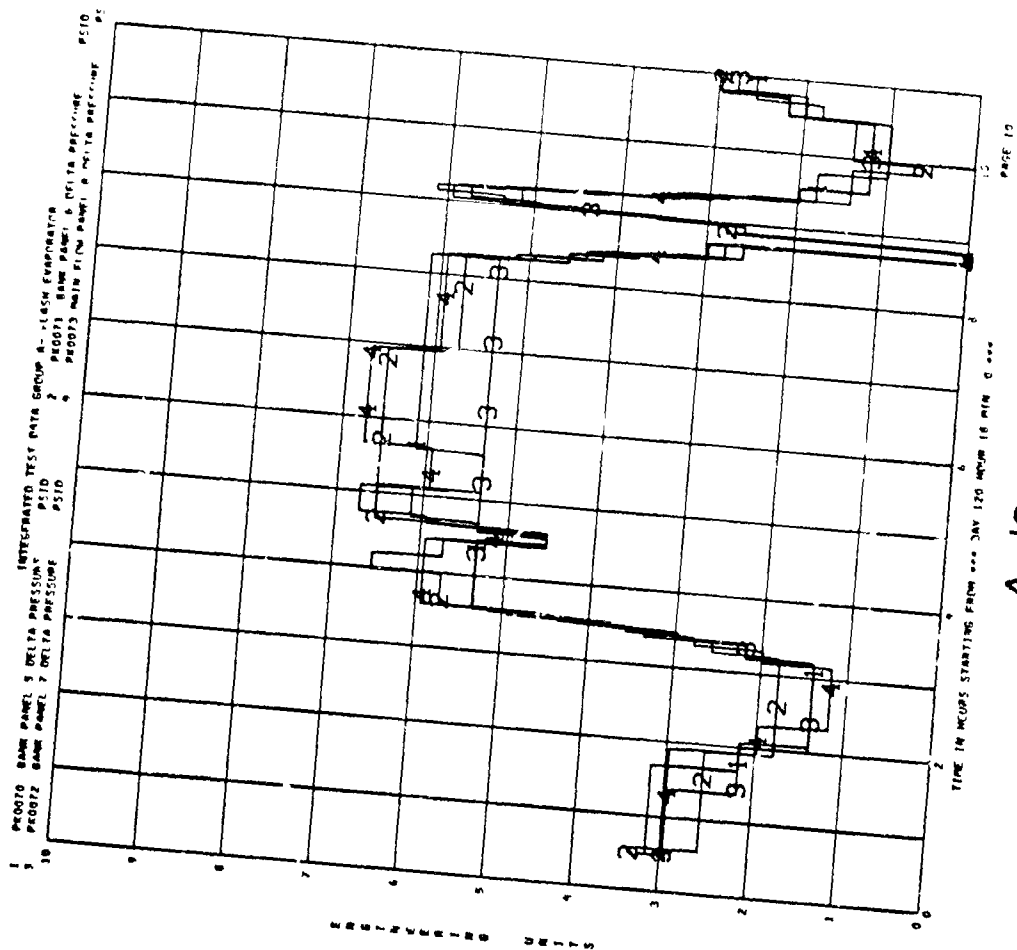
INTERMEDIATE TEST DATA GROUP A- FLASH EVAPORATION
1 PROBES BANK PANEL 1 DELTA PRESSURE PSID
2 PROBES BANK PANEL 2 DELTA PRESSURE PSID
3 PROBES BANK PANEL 3 DELTA PRESSURE PSID
4 PROBES BANK PANEL 4 DELTA PRESSURE PSID



A-7

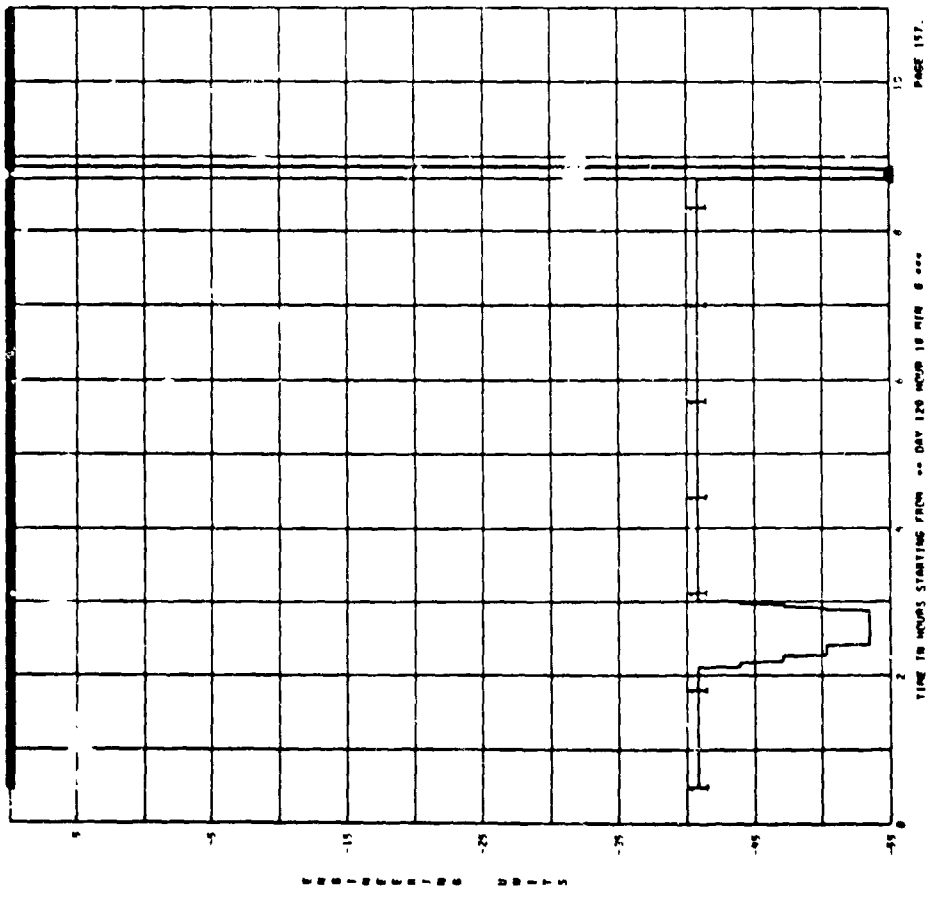


A-9



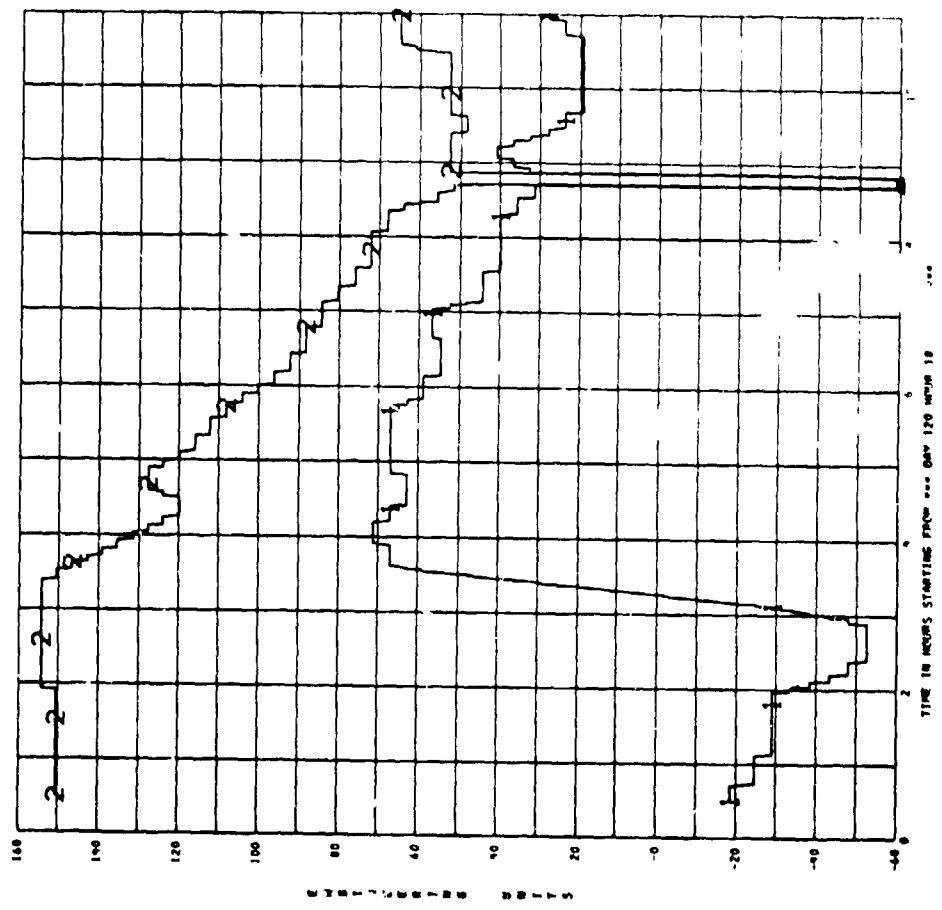
A-10

1 110037 BANK TUBES INLET TO MIX VALVE DES F 2 110038 PRIME TUBES INLET TO MIX VALVE DES



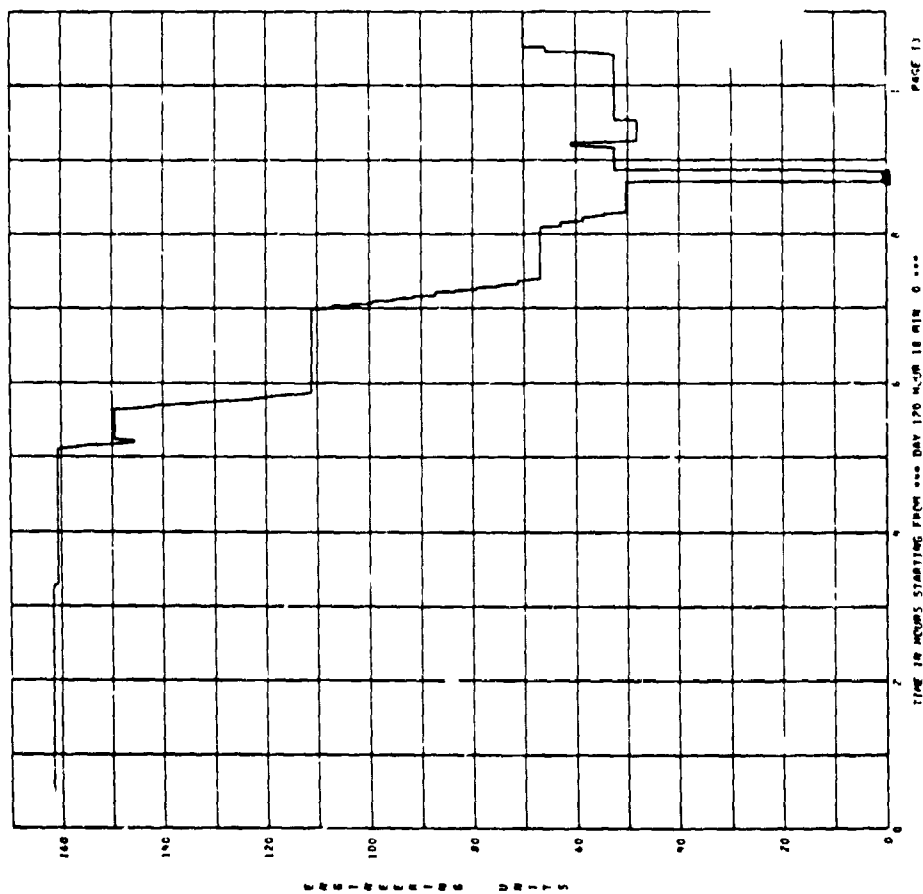
A-11

1 110037 BANK TUBES INLET TO MIX VALVE DES F 2 110038 PRIME TUBES INLET TO MIX VALVE DES



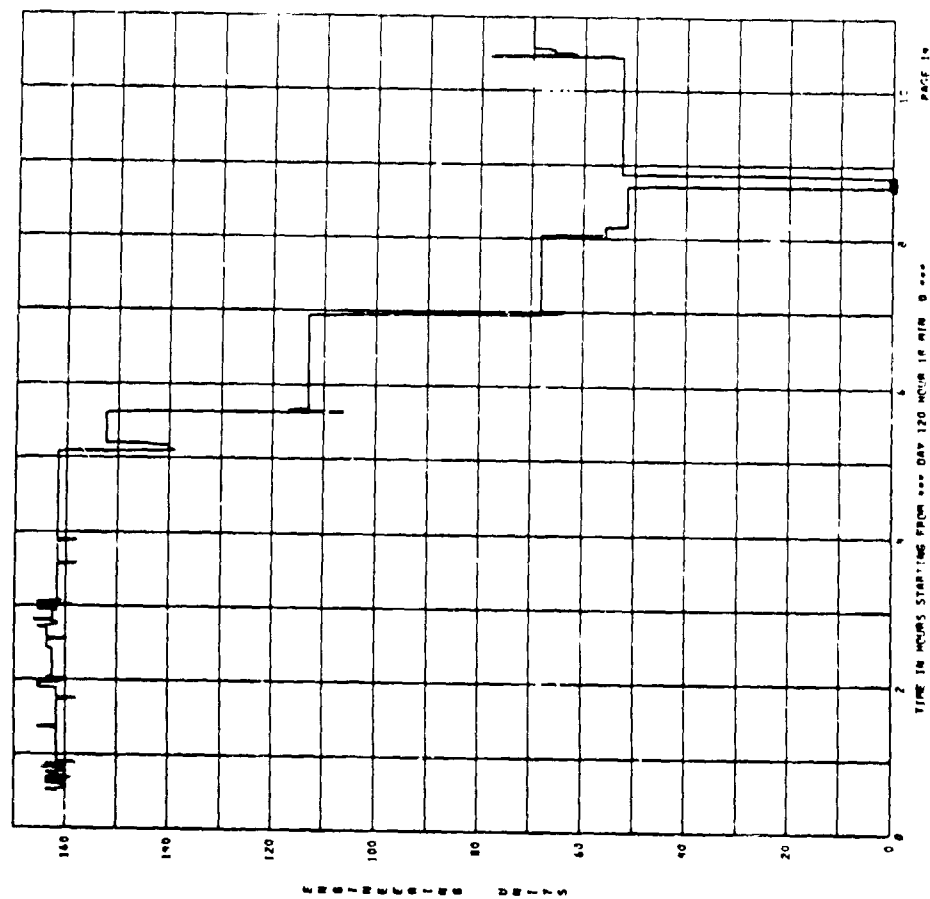
A-12

1 INTEGRATED TEST DATA GROUP A - FLASH EVAPORATOR
DEG F

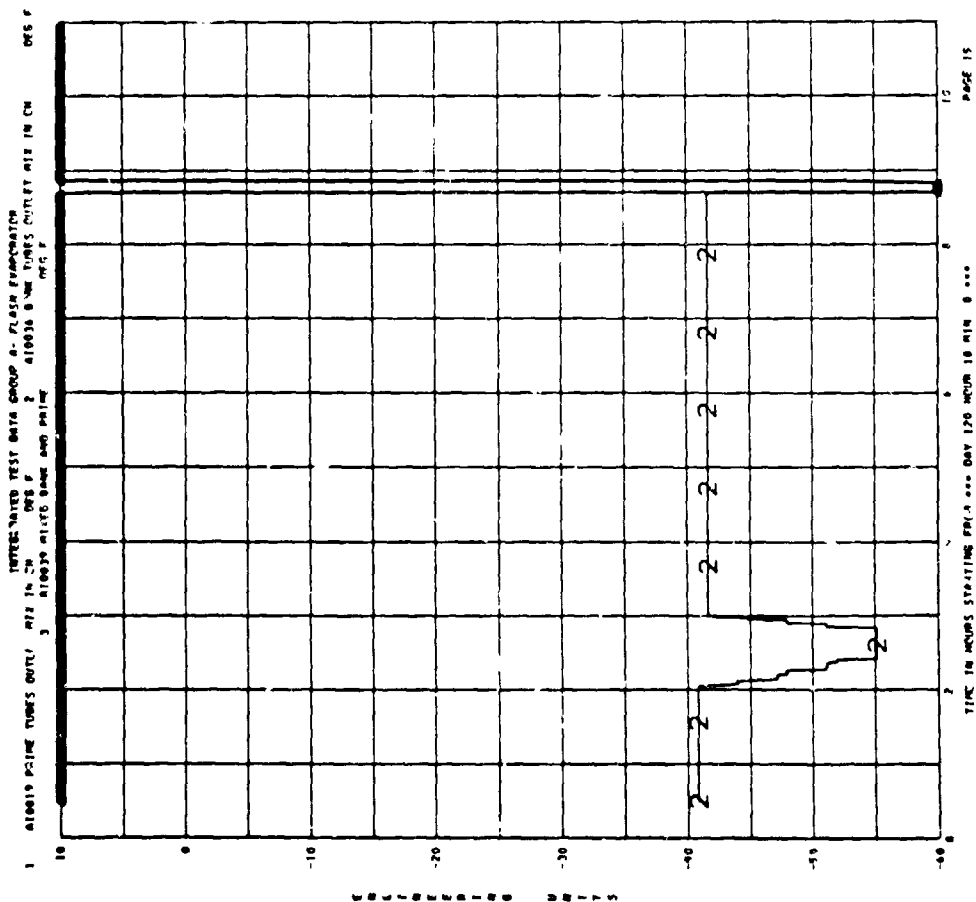


A-13

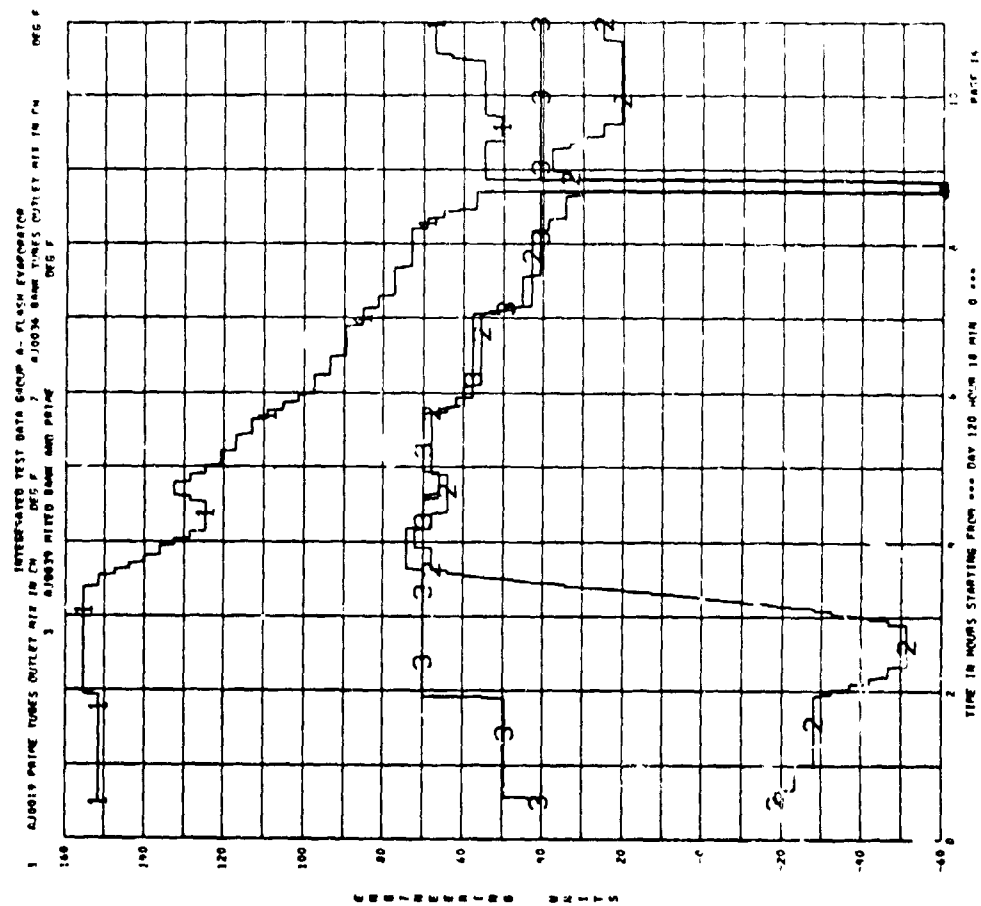
1 INTEGRATED TEST DATA GROUP A - FLASH EVAPORATOR
DEG F



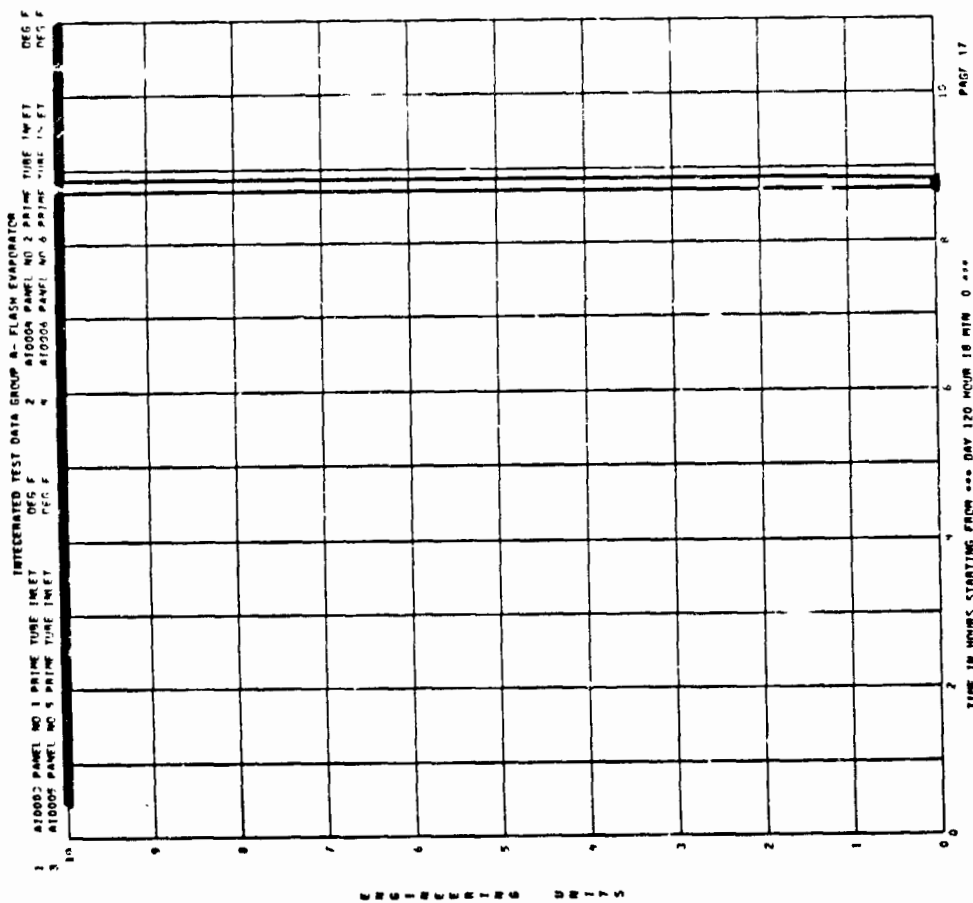
A-14

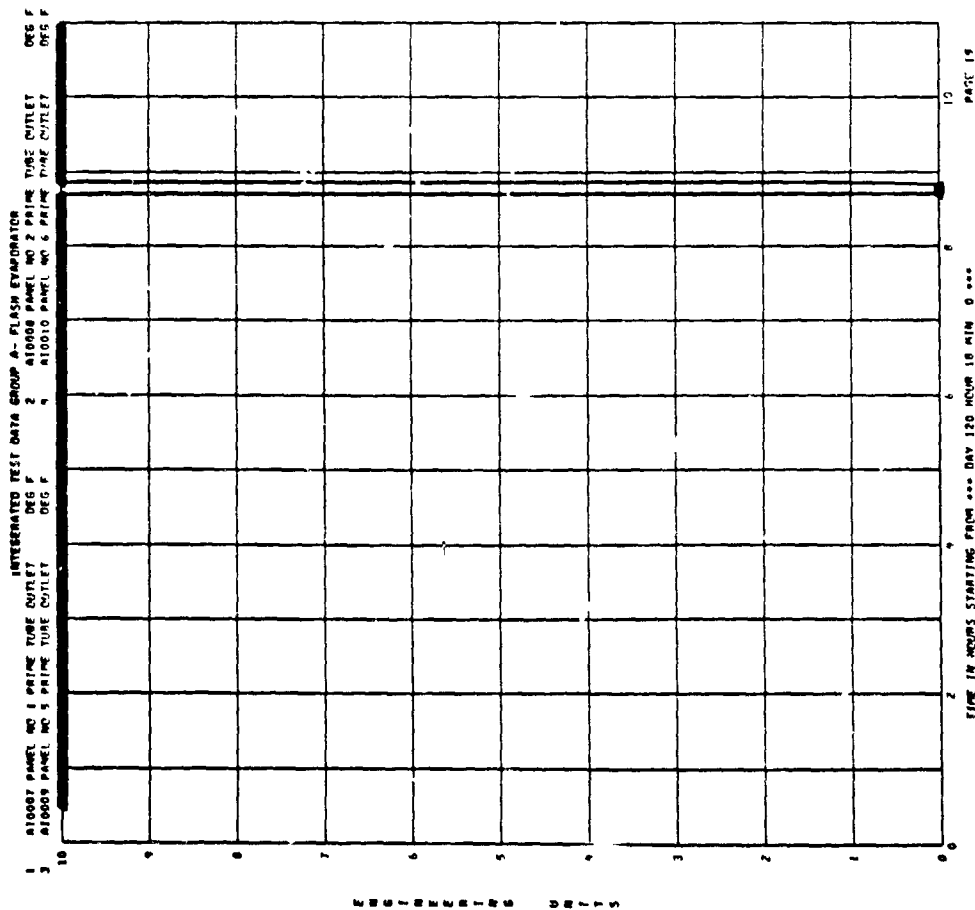


A-15

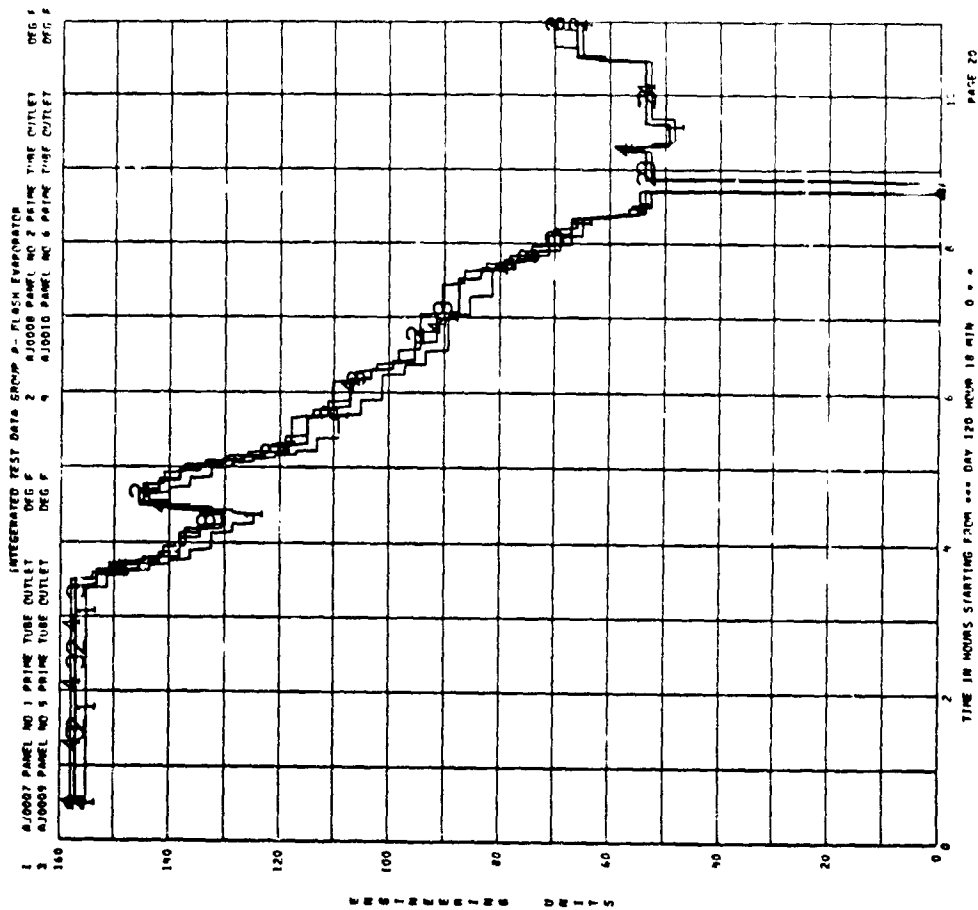


A-16

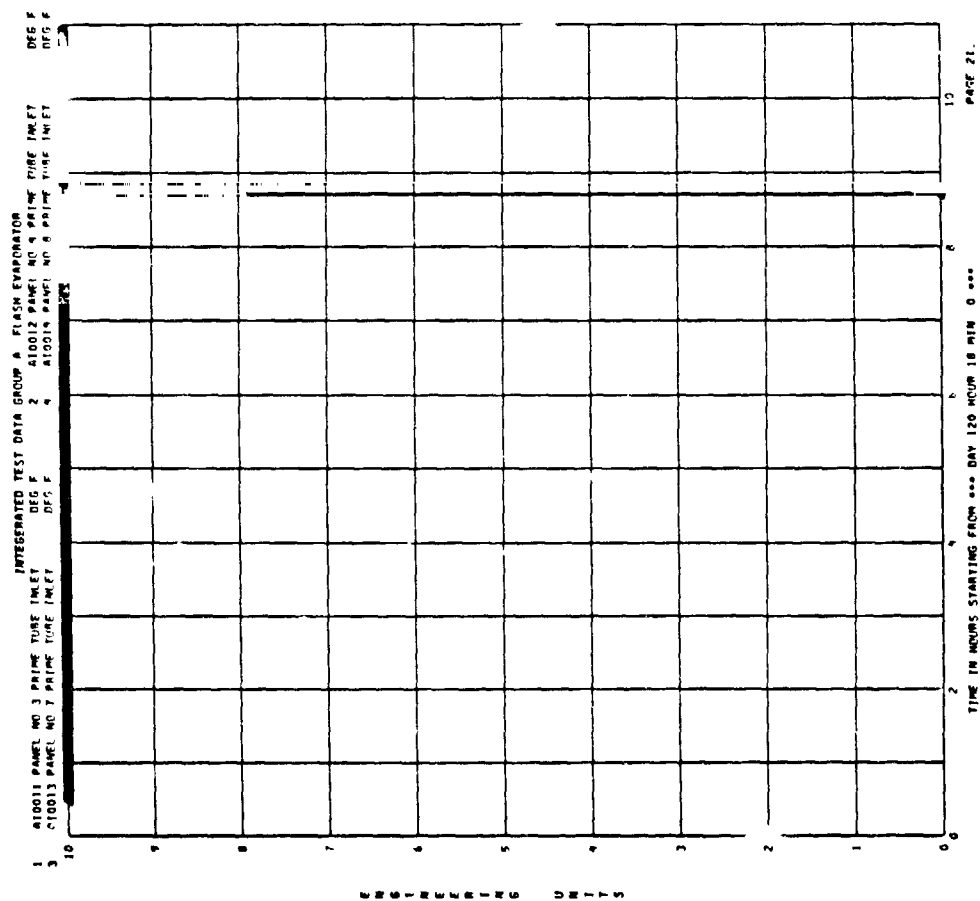




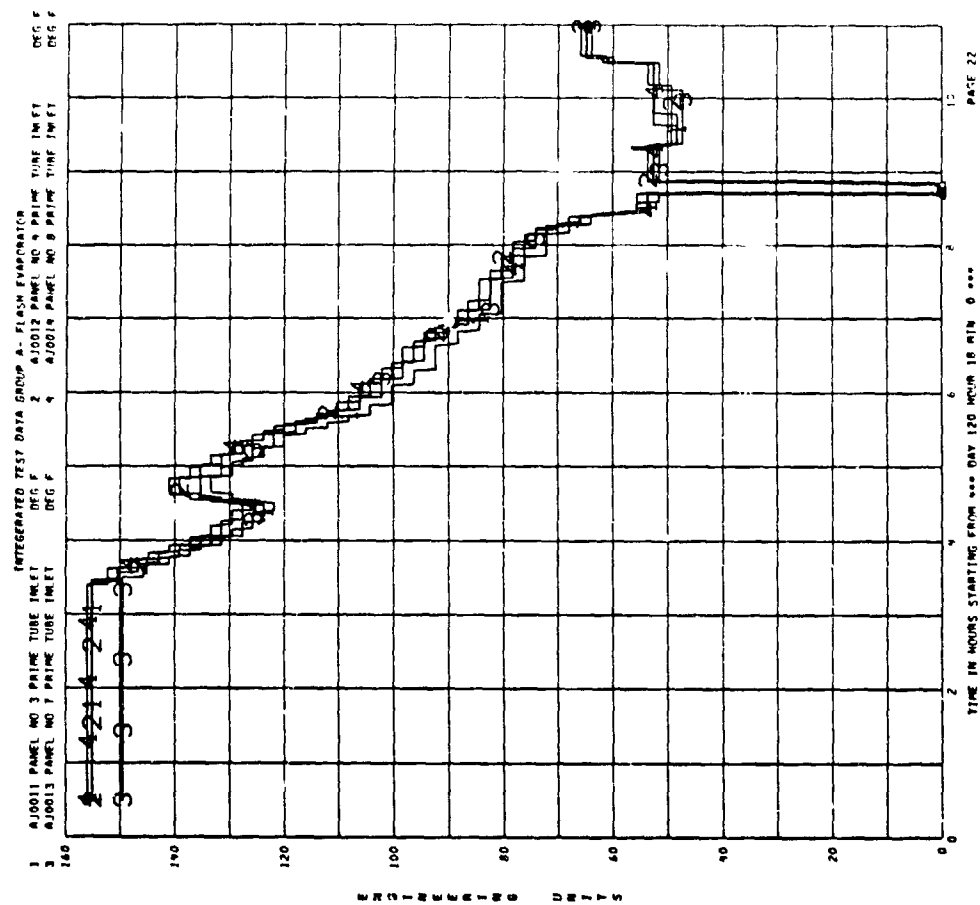
A-19



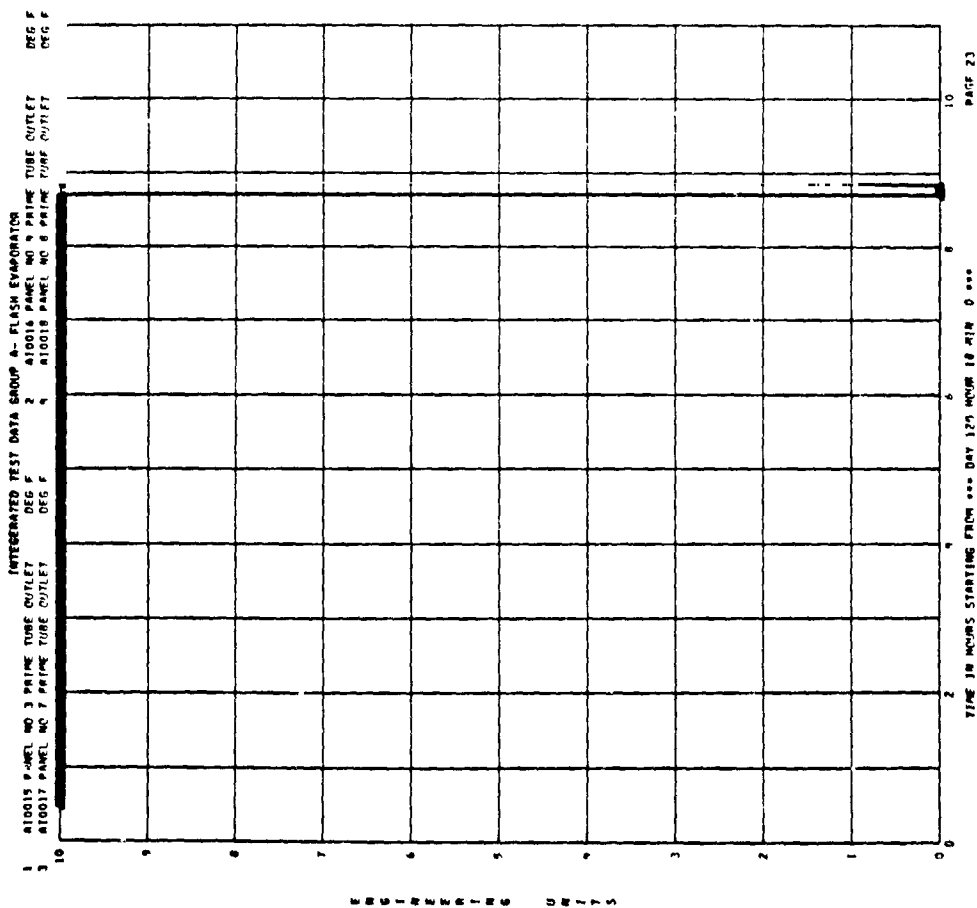
A-20



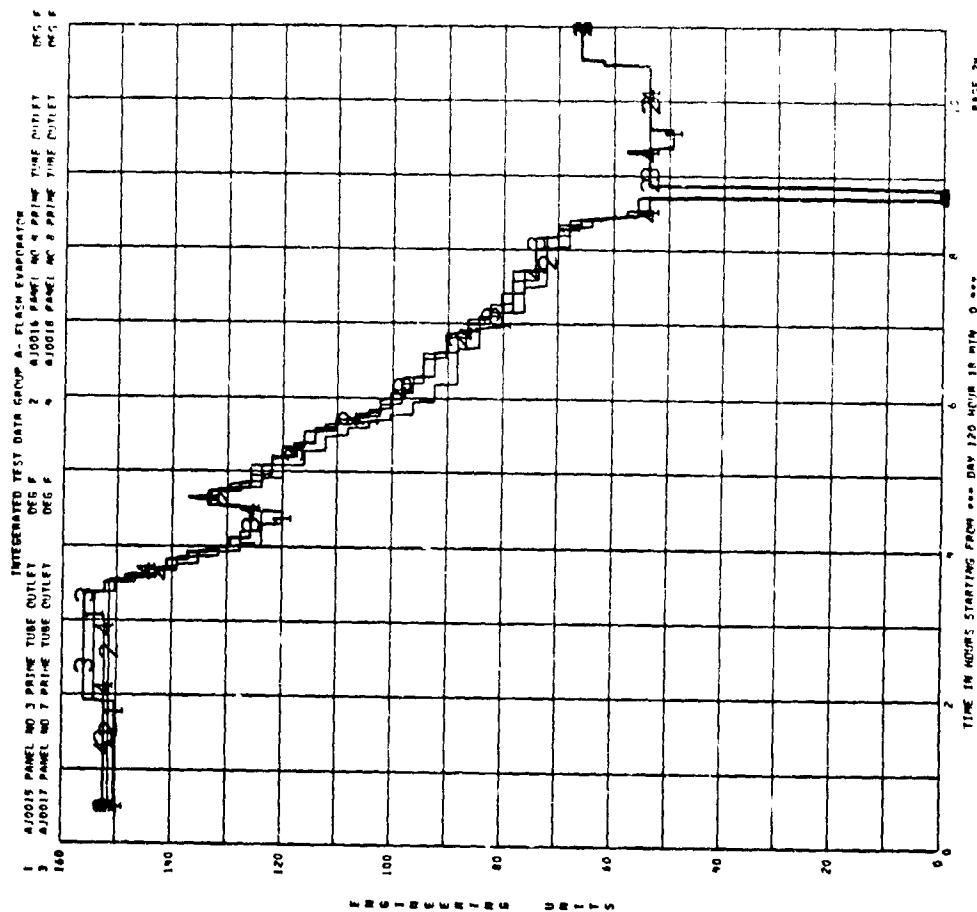
A-21



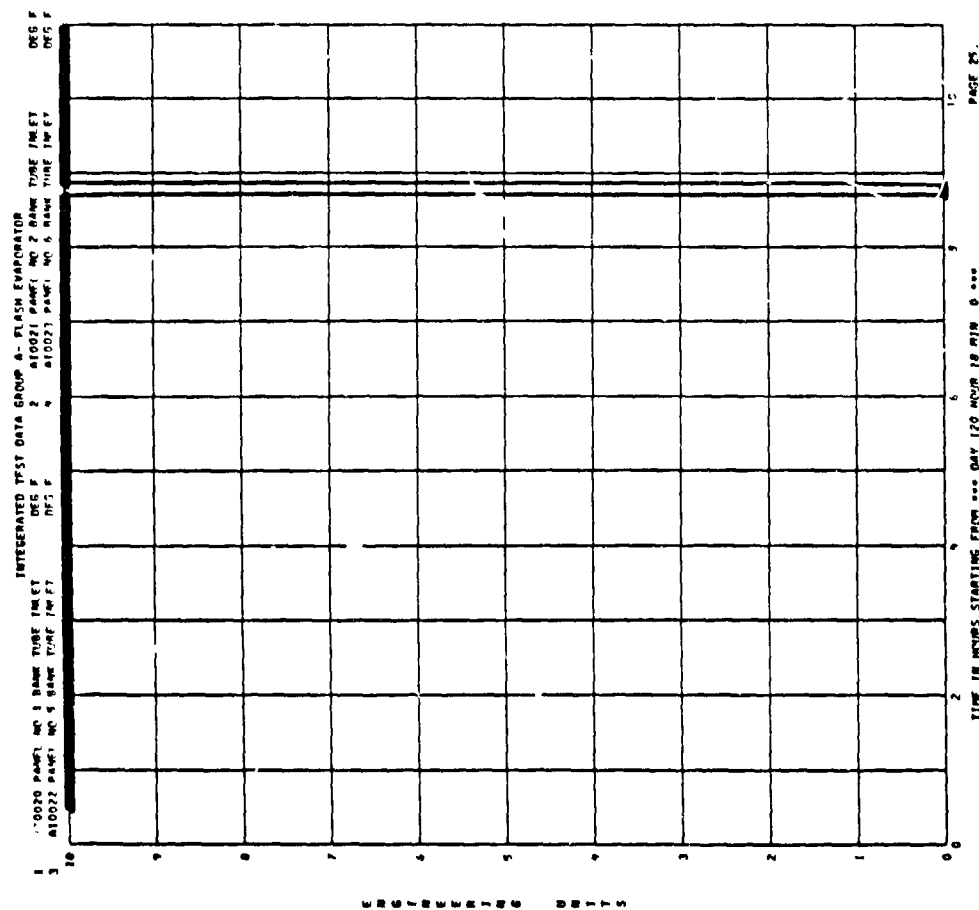
A-22



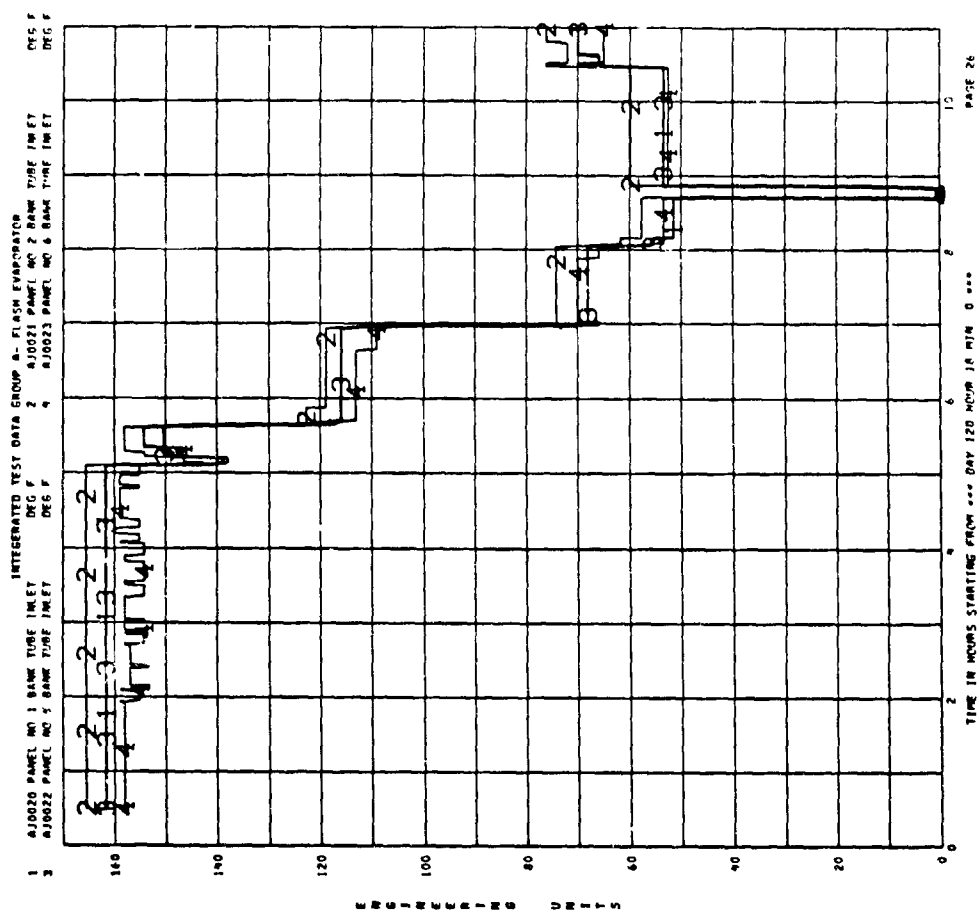
A-23



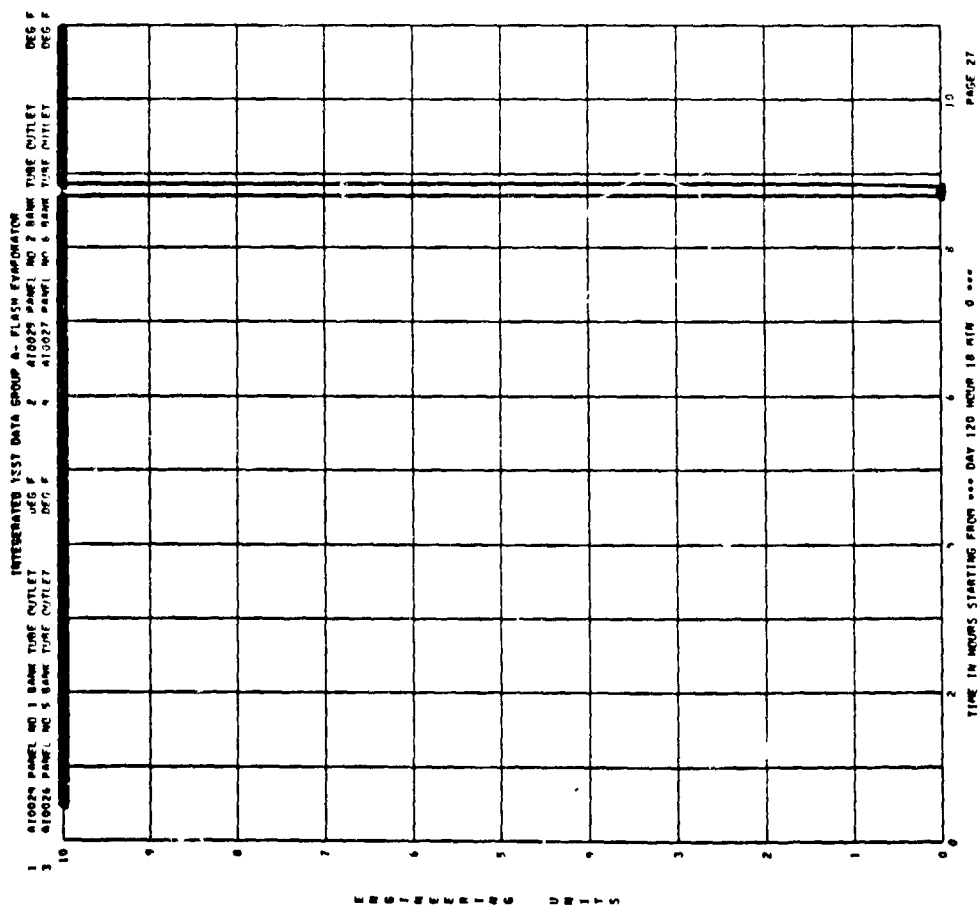
A-24



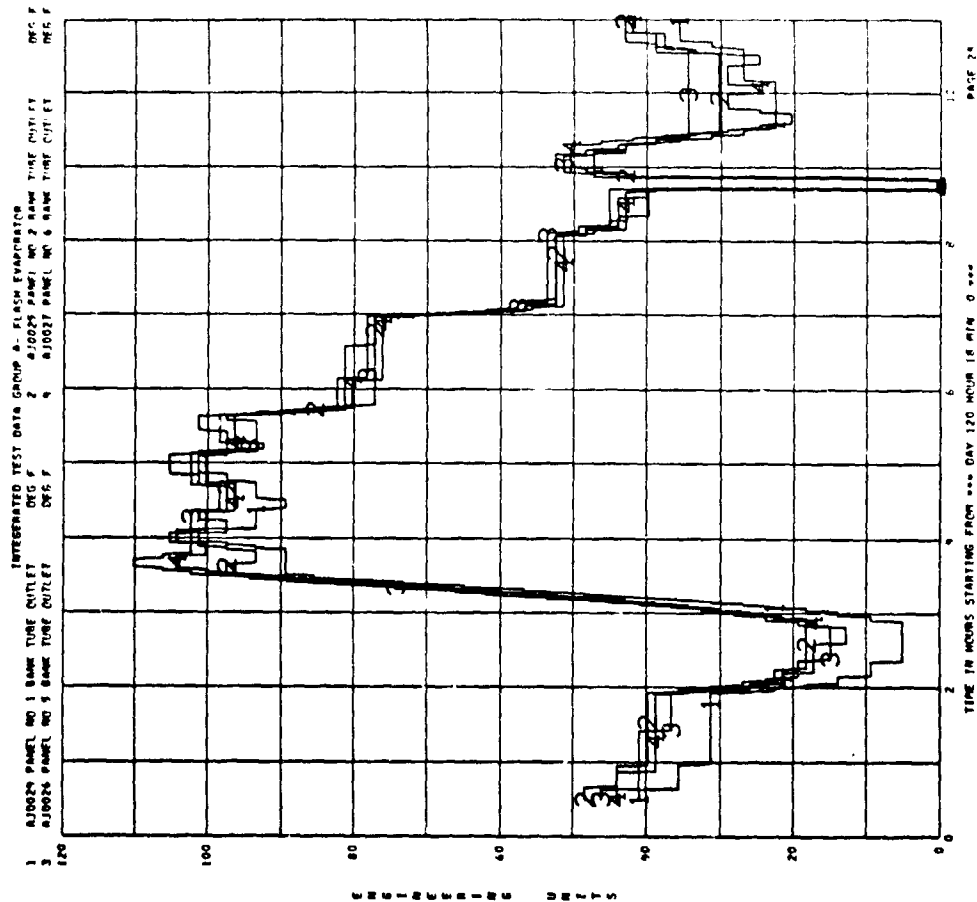
A-25

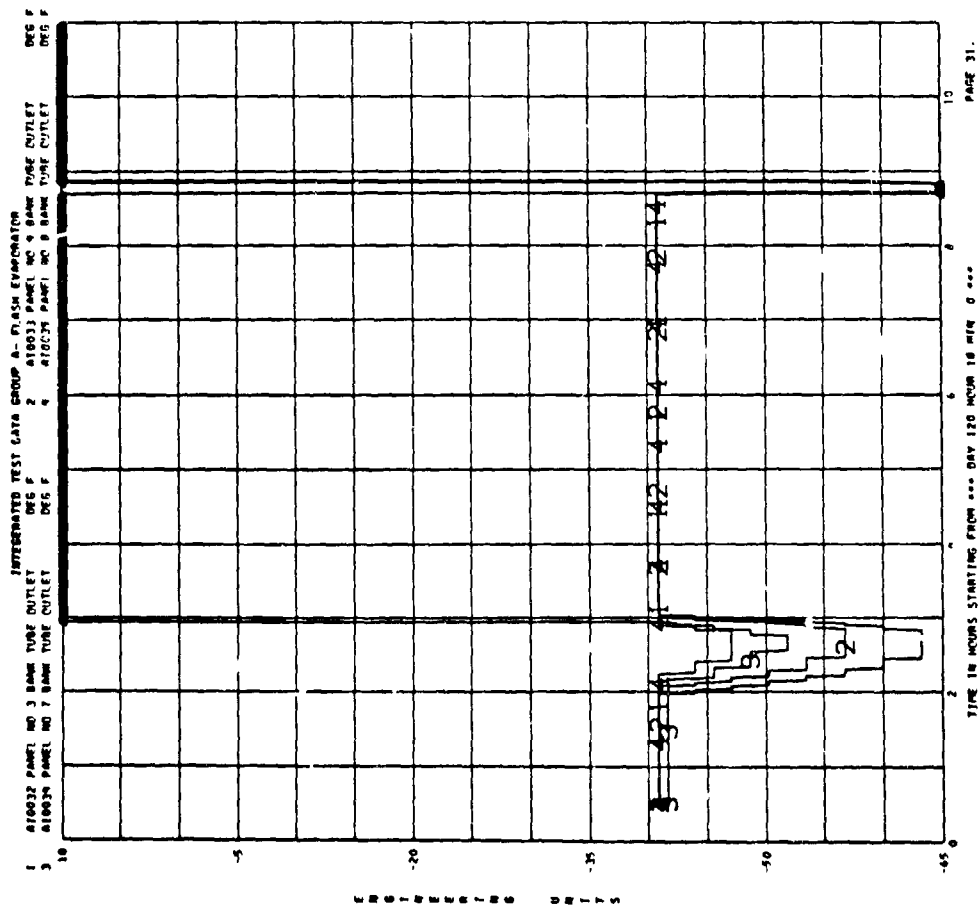


A-26

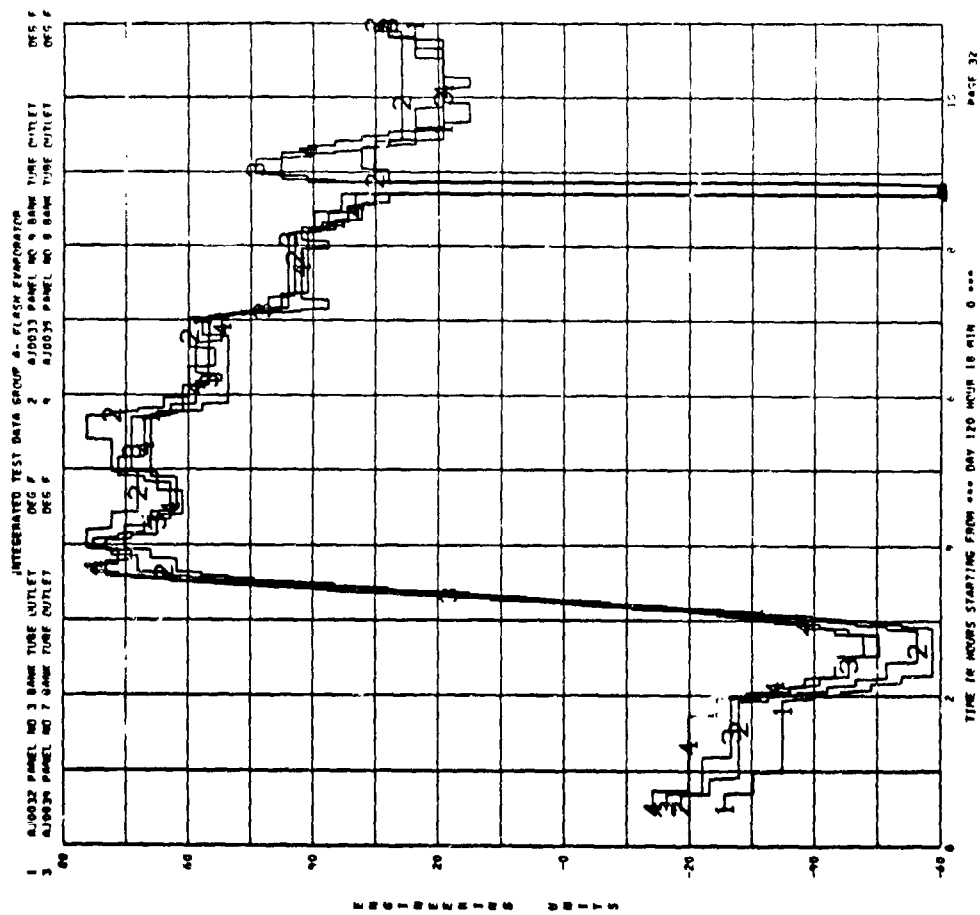


A-27

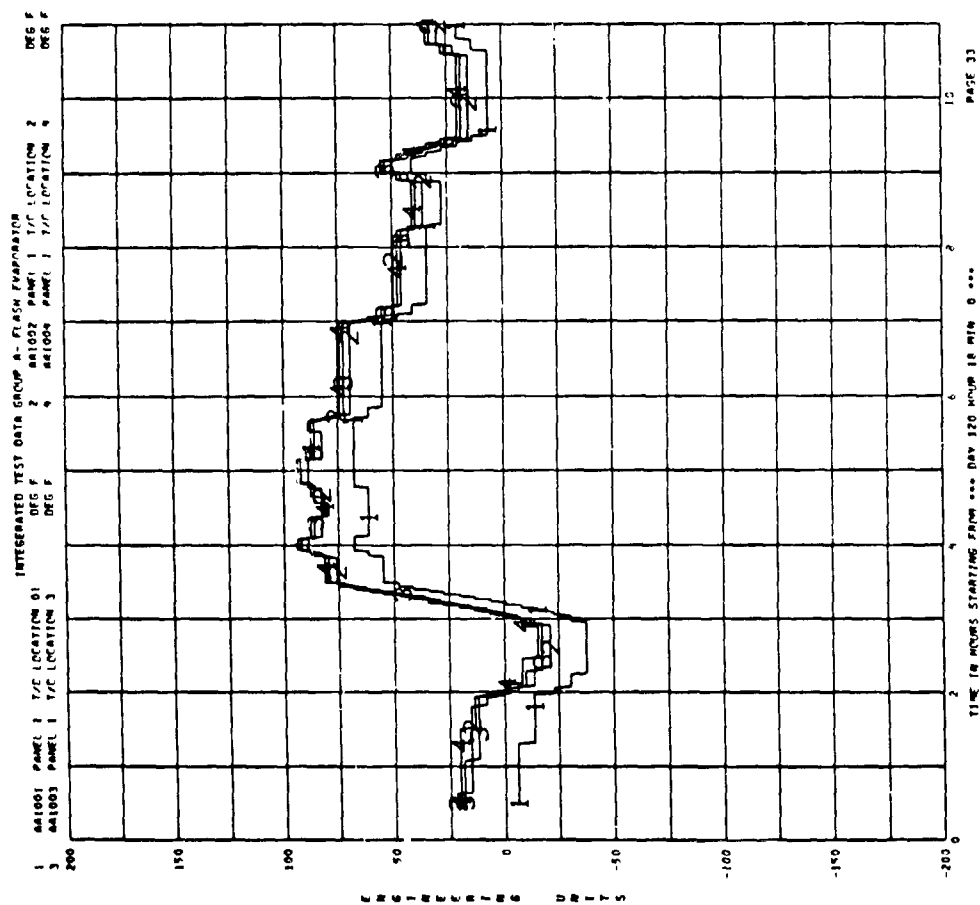




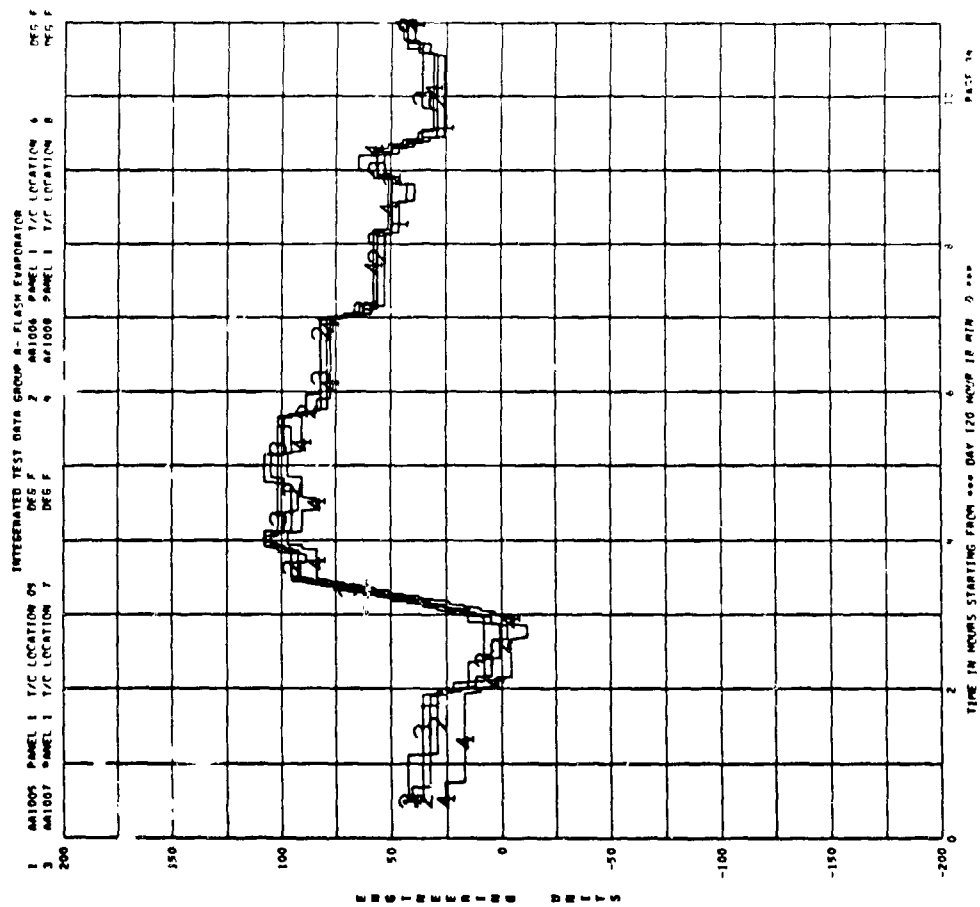
A-31



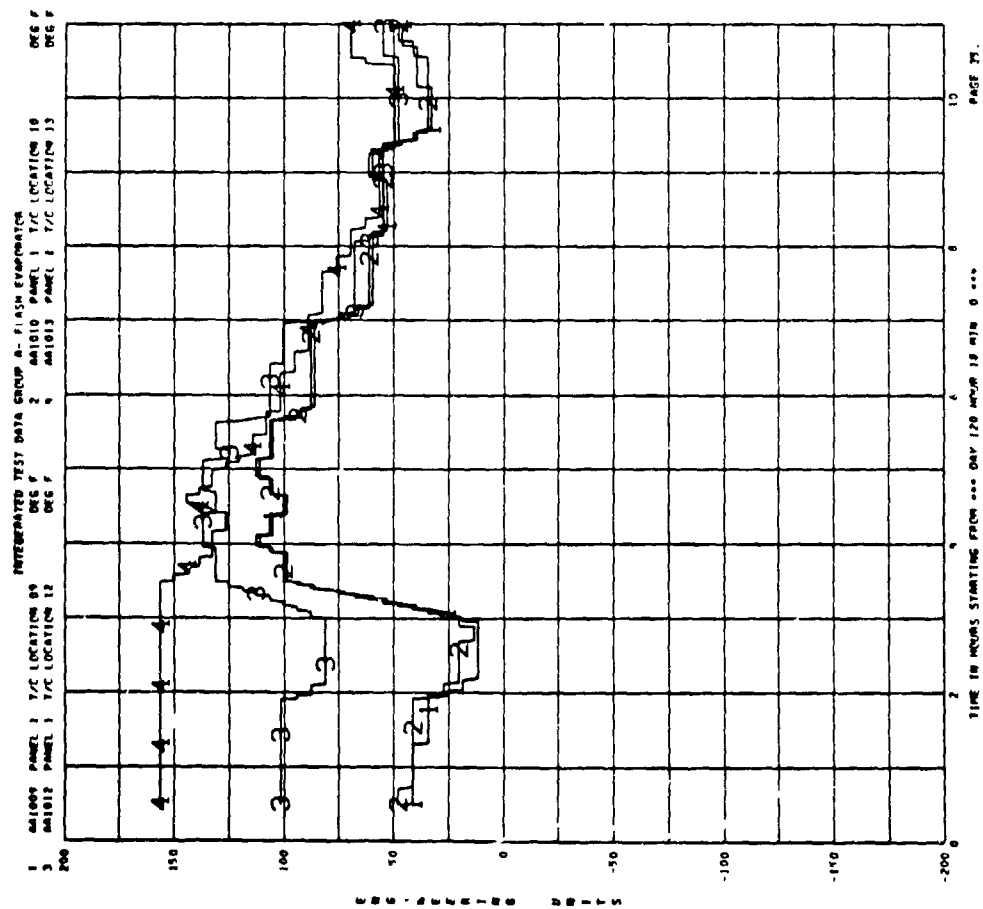
A-32



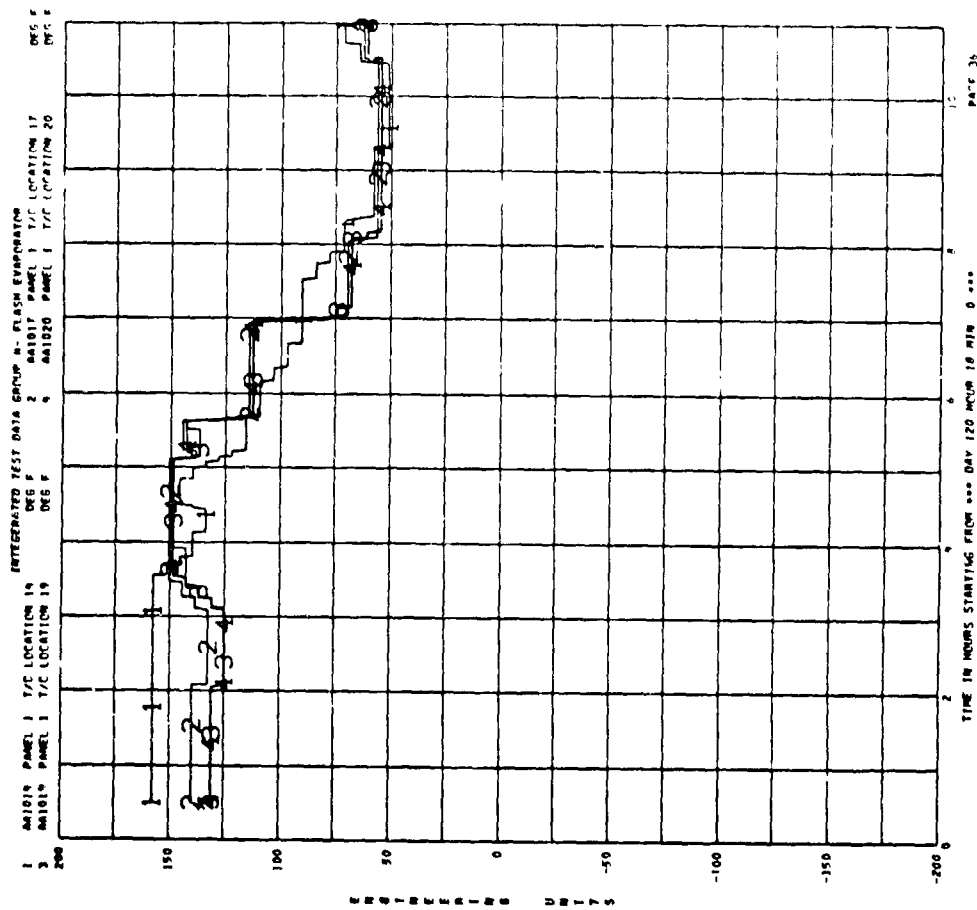
A-33



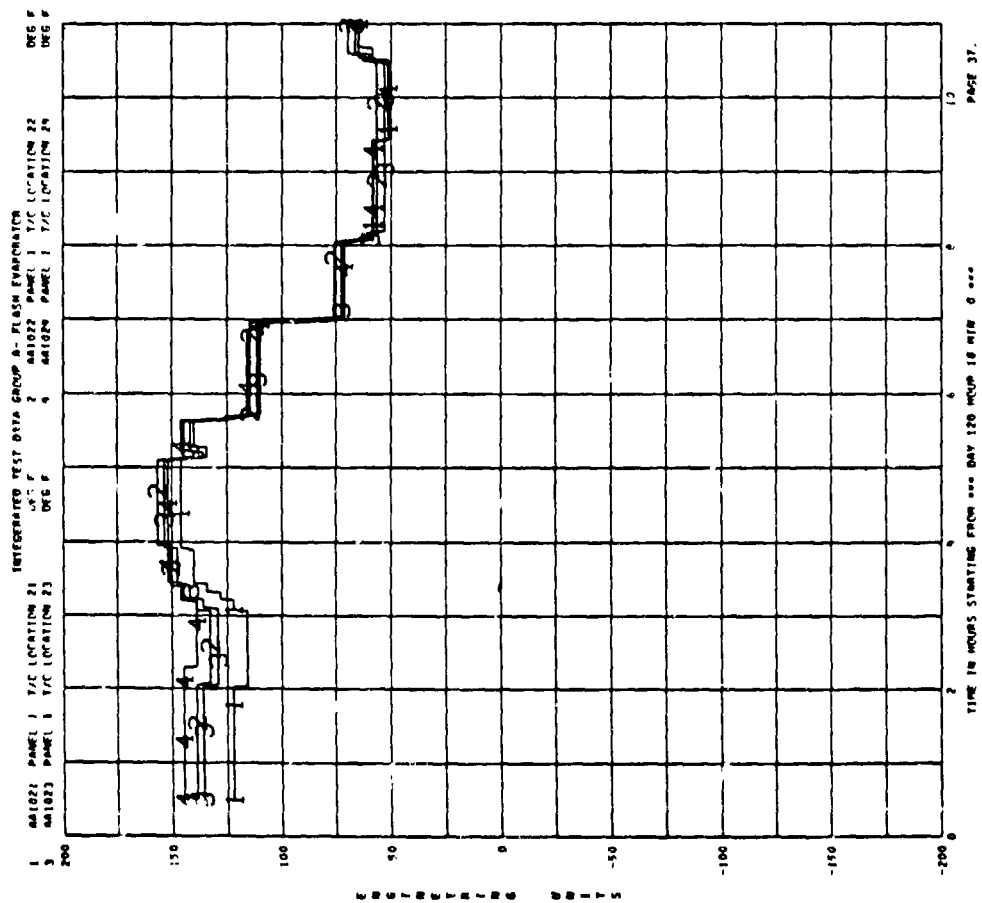
A-34



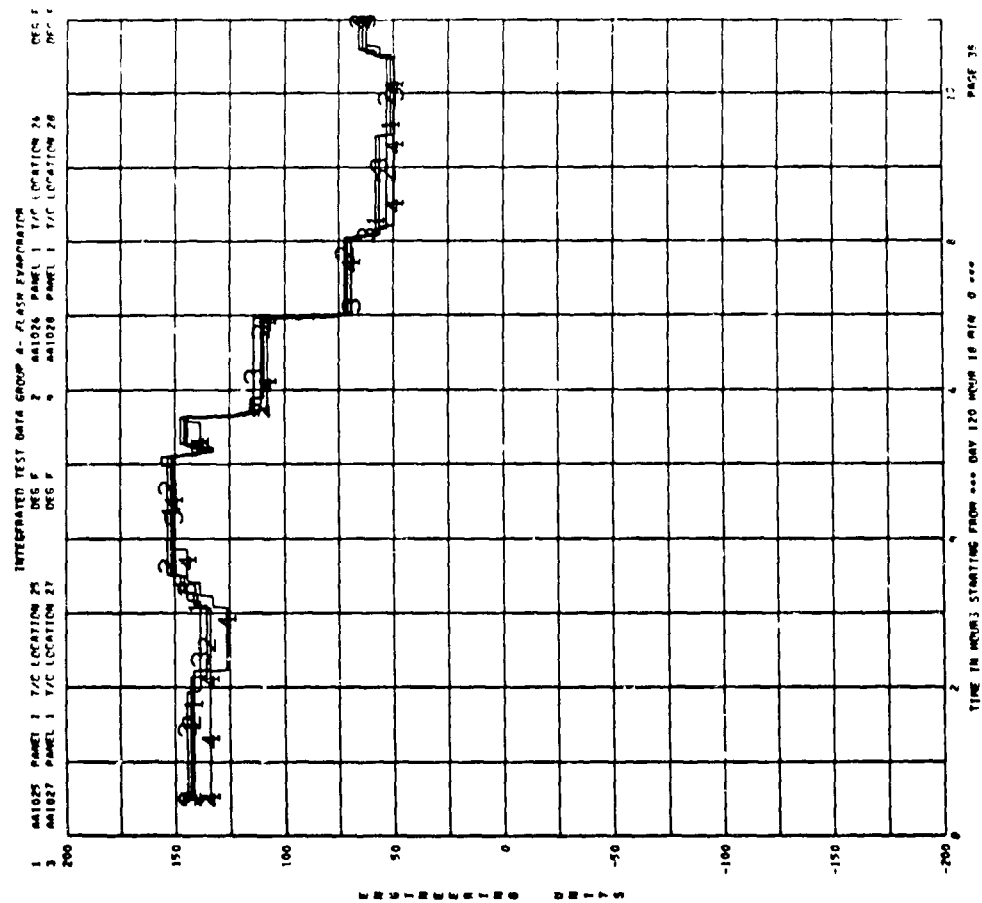
A-35



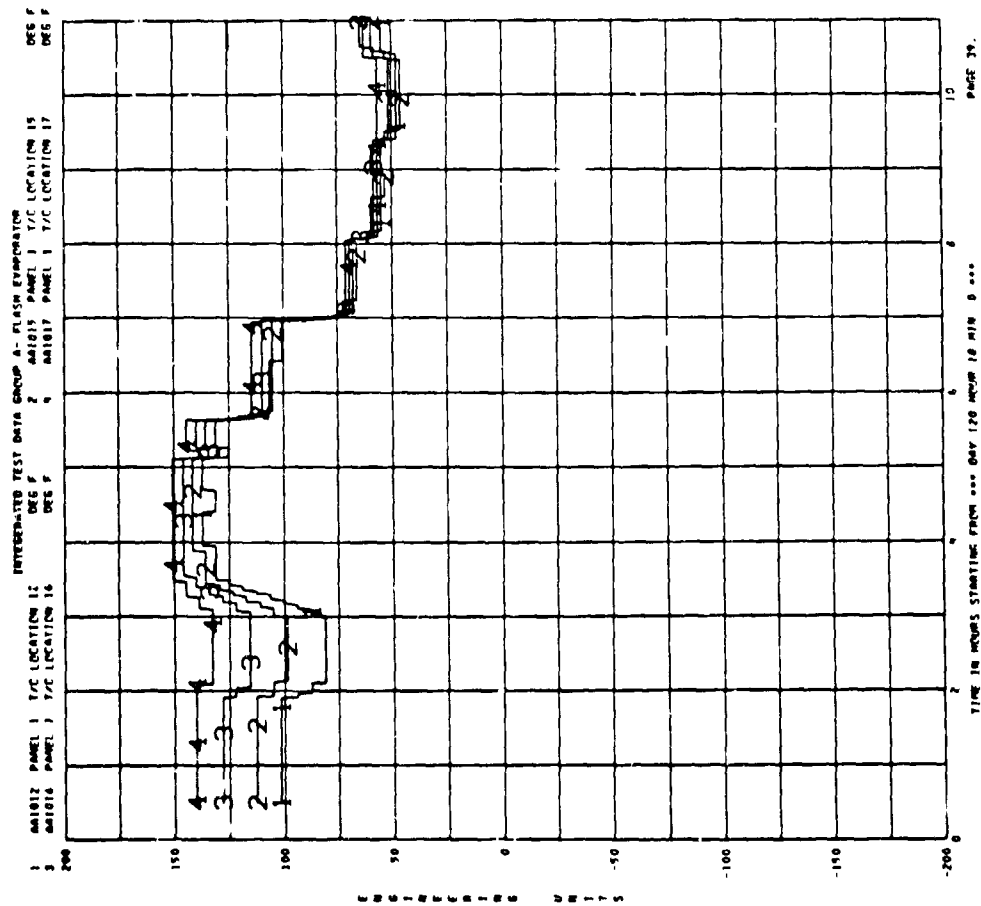
A-36



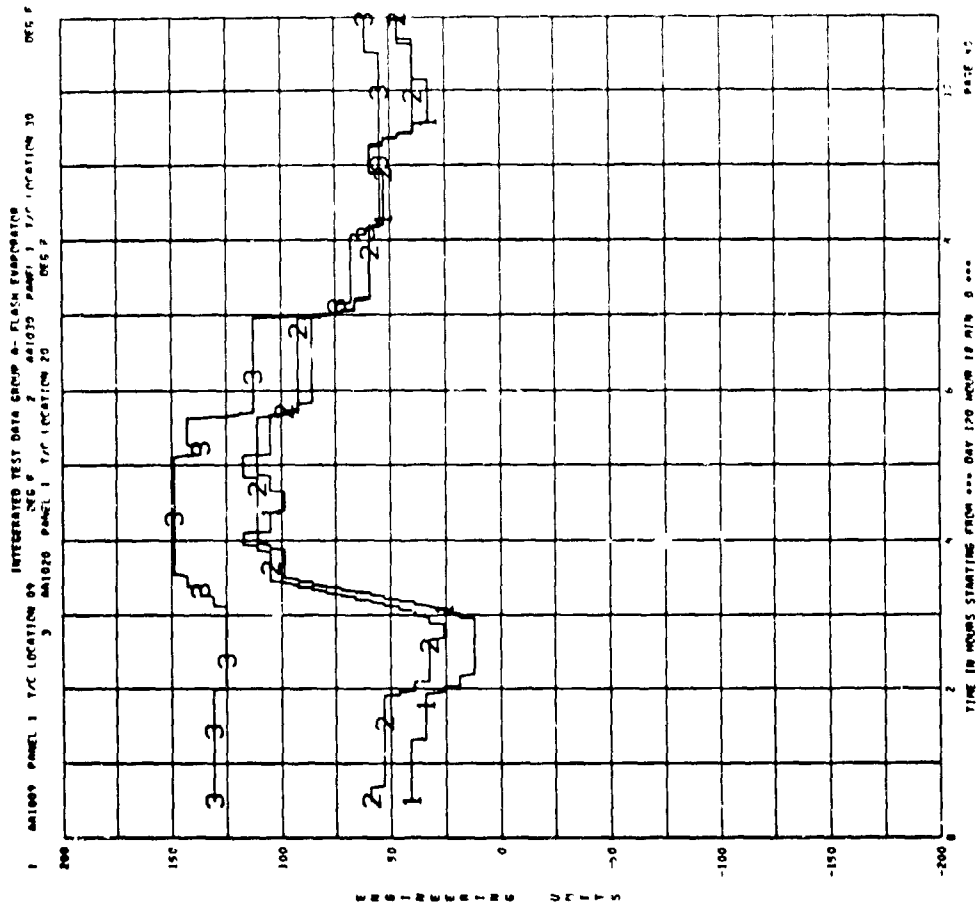
A-37



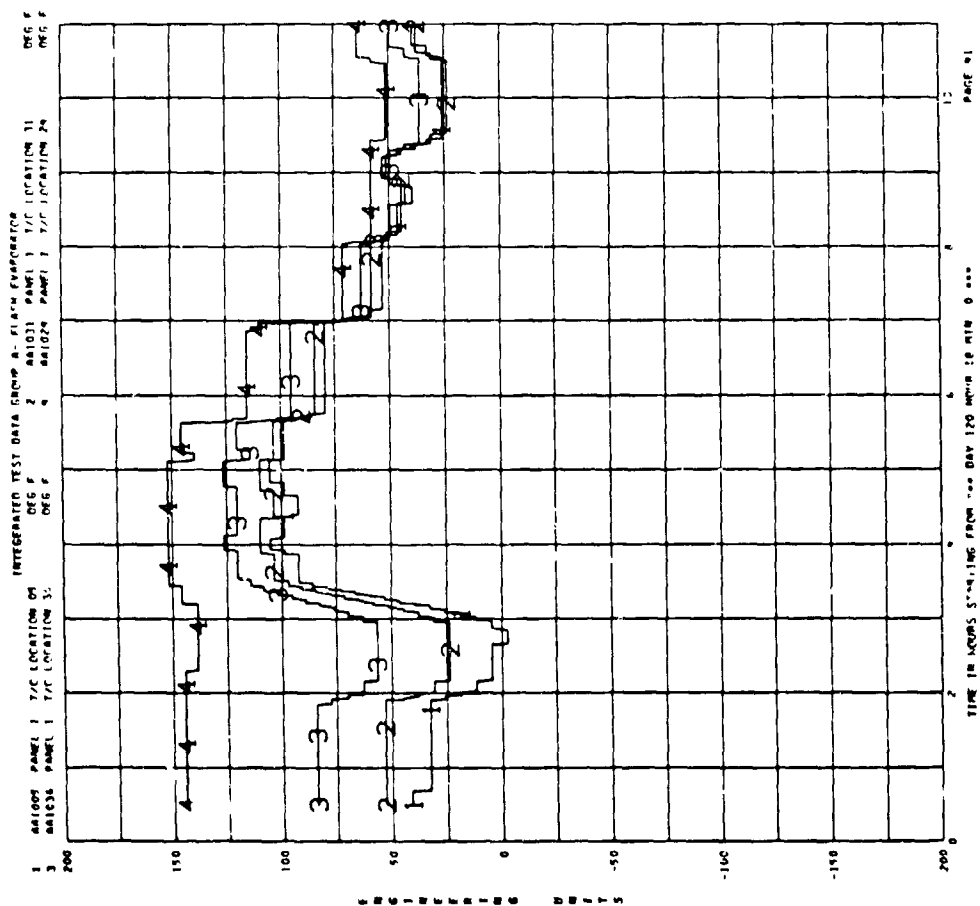
A-38



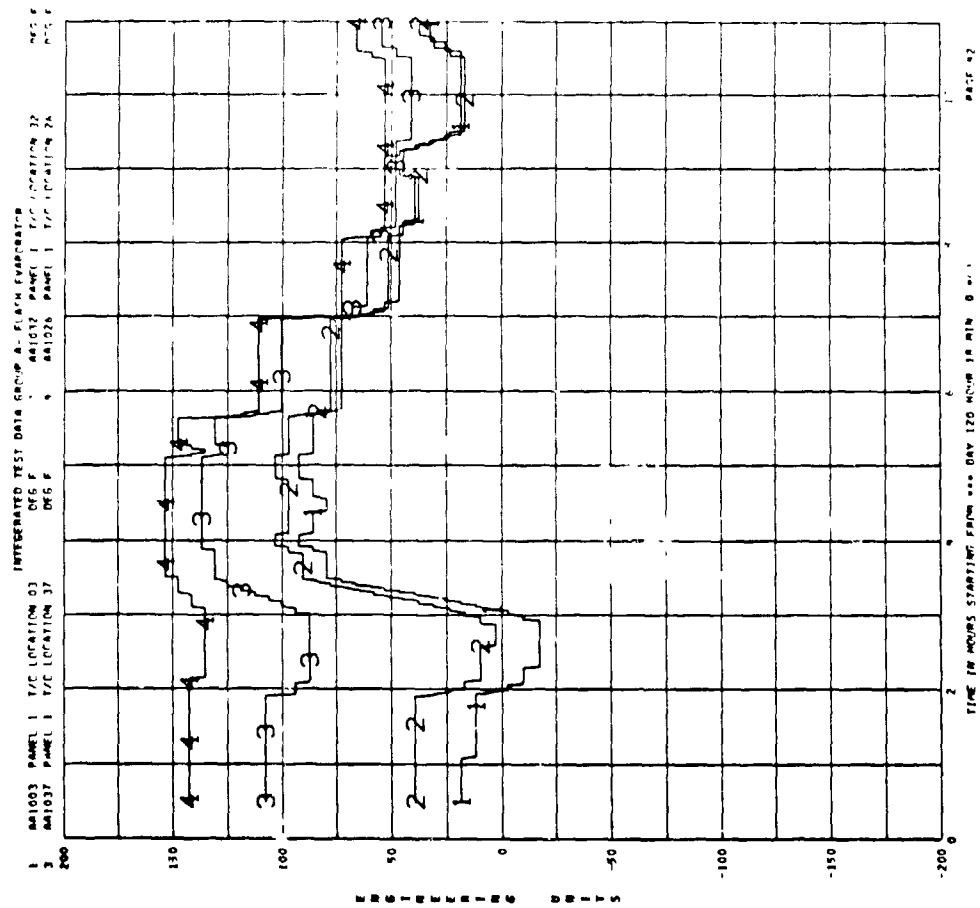
A-39



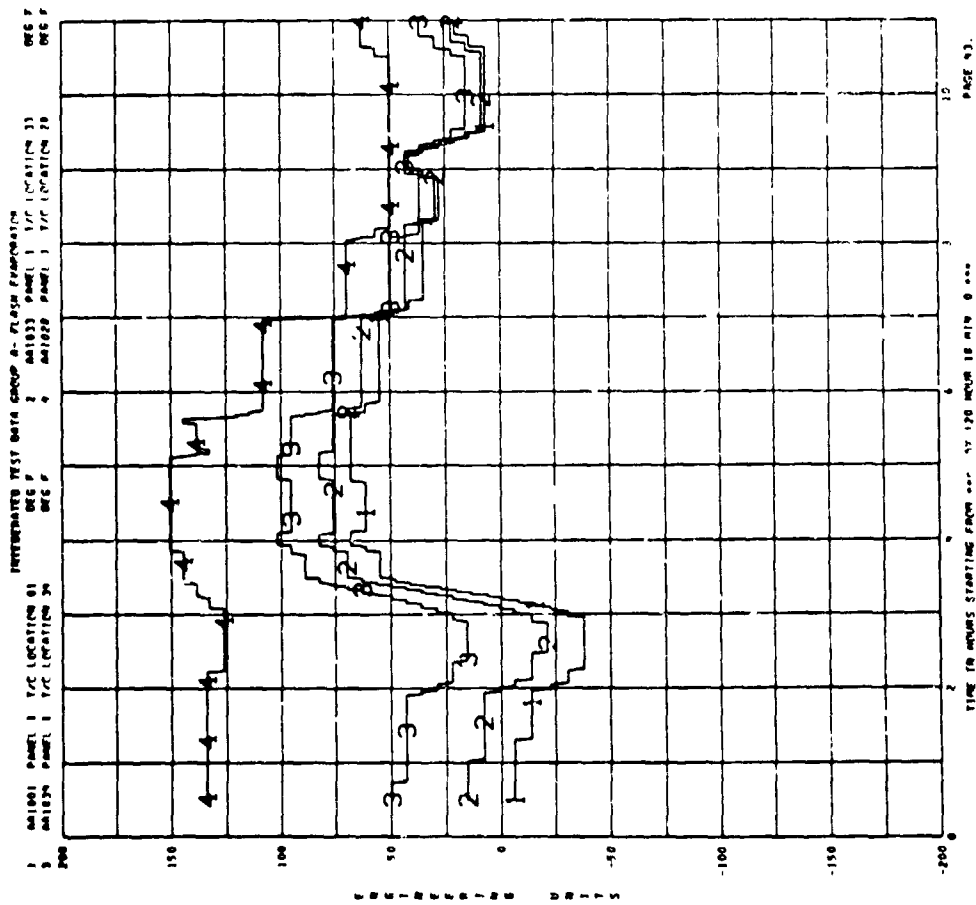
A-40



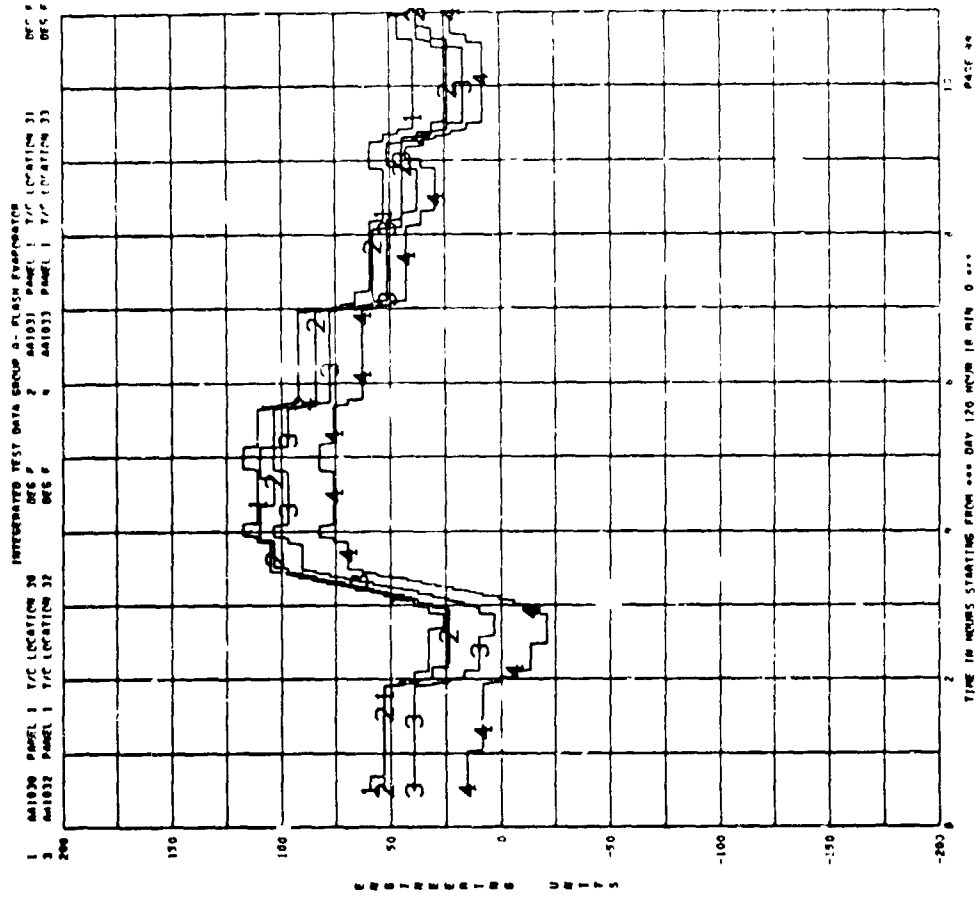
A-41



A-42



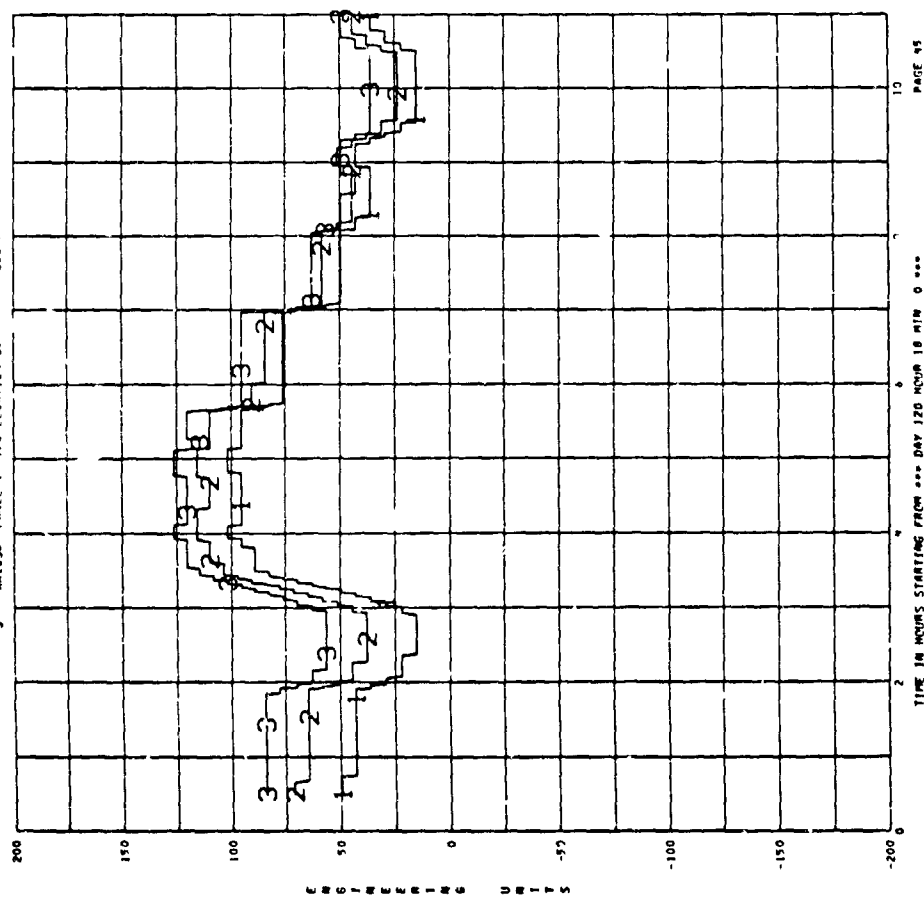
A-43



A-44

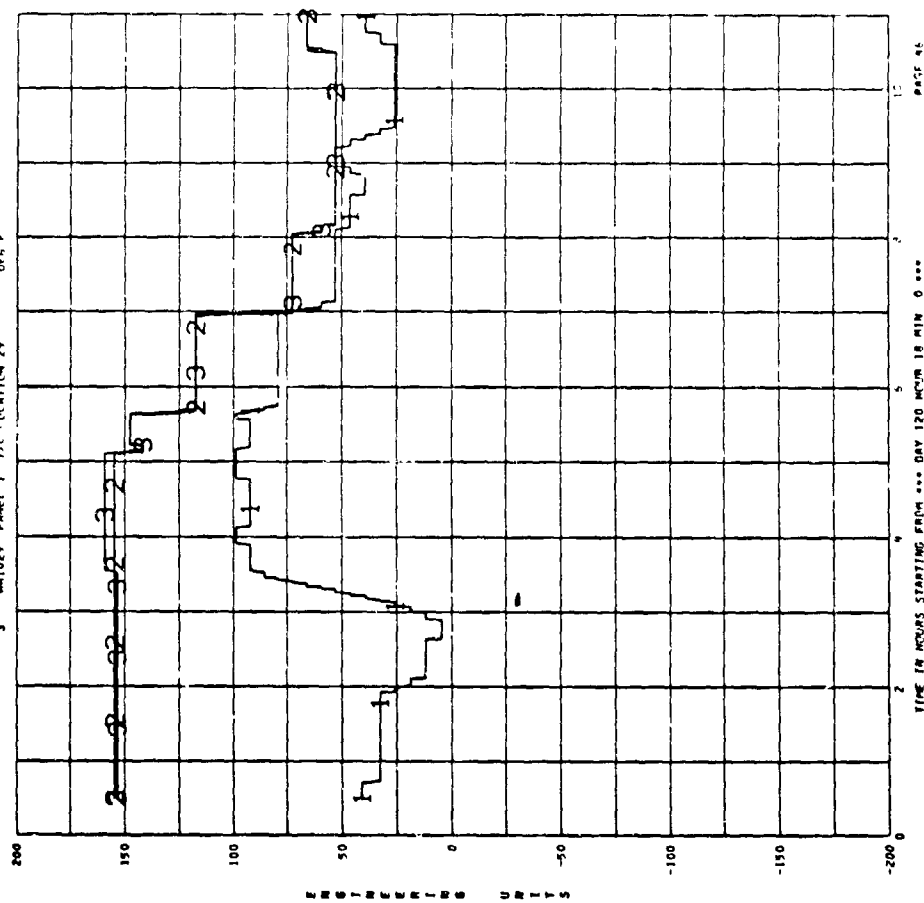
INTEGRATED TEST DATA GROUP A- FLASH EVAPORATOR

| | | | | | | | |
|--------|---------|-----------------|---|--------|---------|-----------------|-----------------|
| AA:034 | PANEL 1 | T/C LOCATION 34 | 2 | AA1035 | PANEL 1 | T/C LOCATION 35 | |
| | | | | 3 | AA1036 | PANEL 1 | T/C LOCATION 36 |
| | | | | | | | DE5 F |
| | | | | | | | DE6 F |

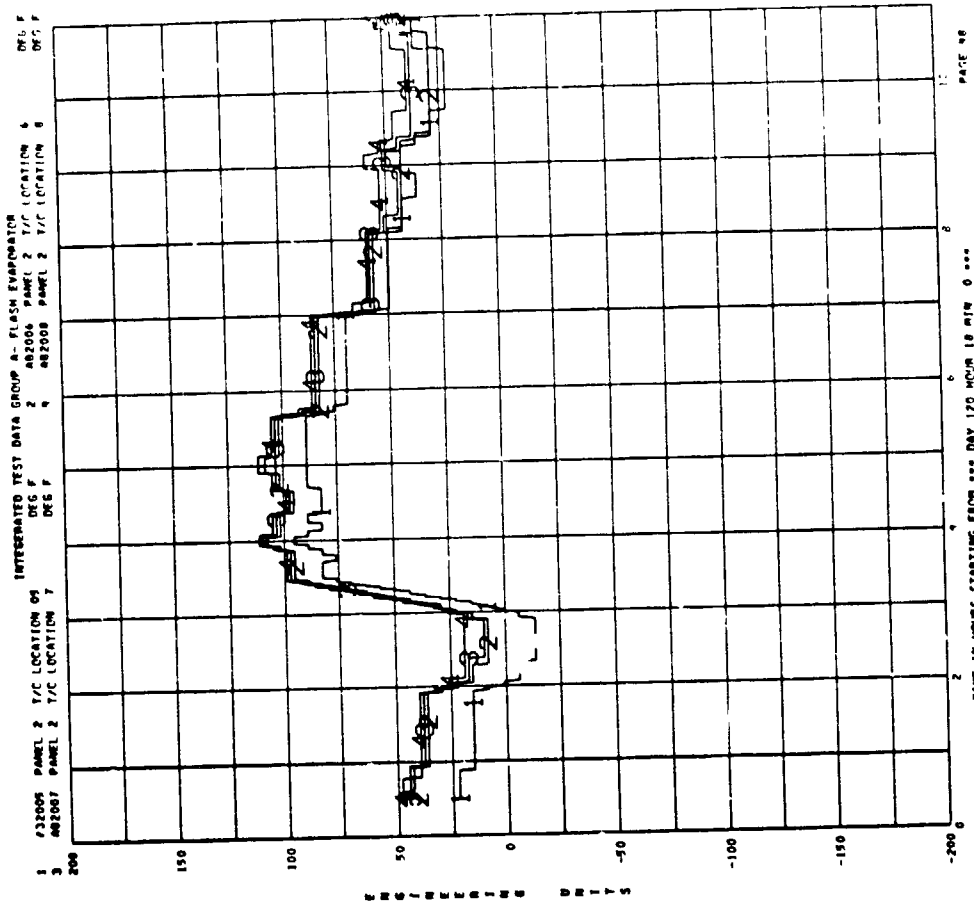
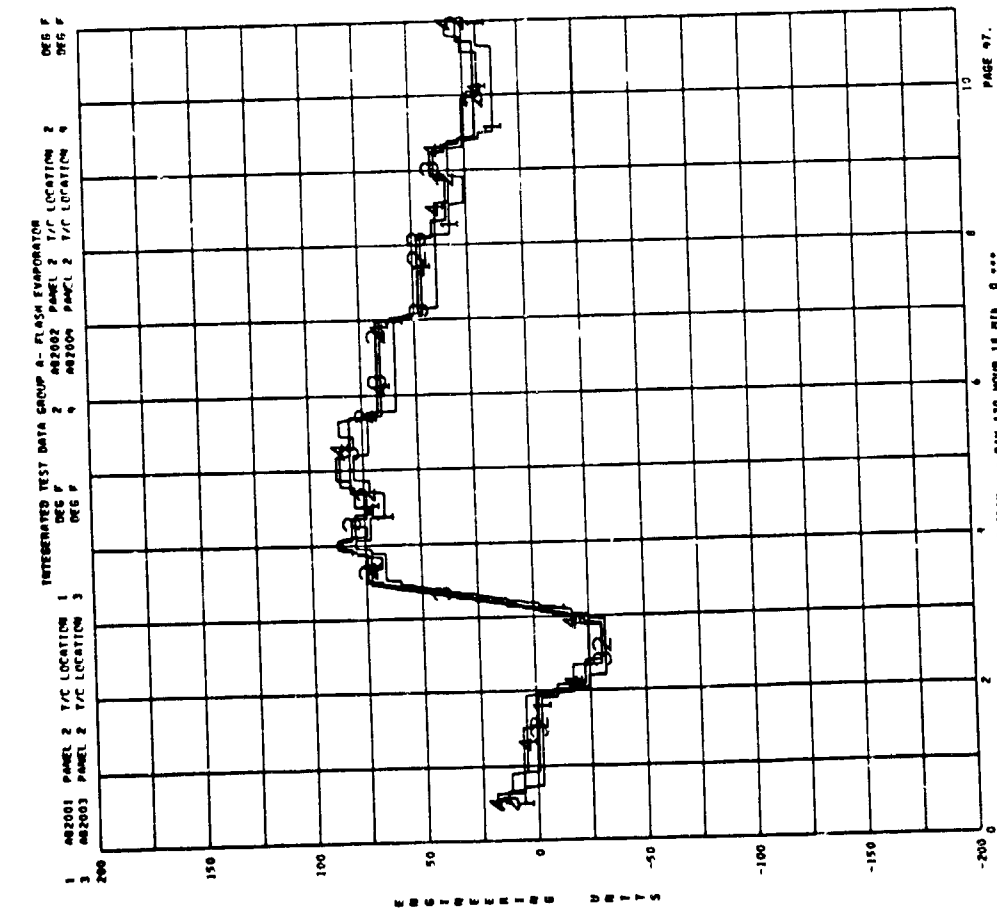


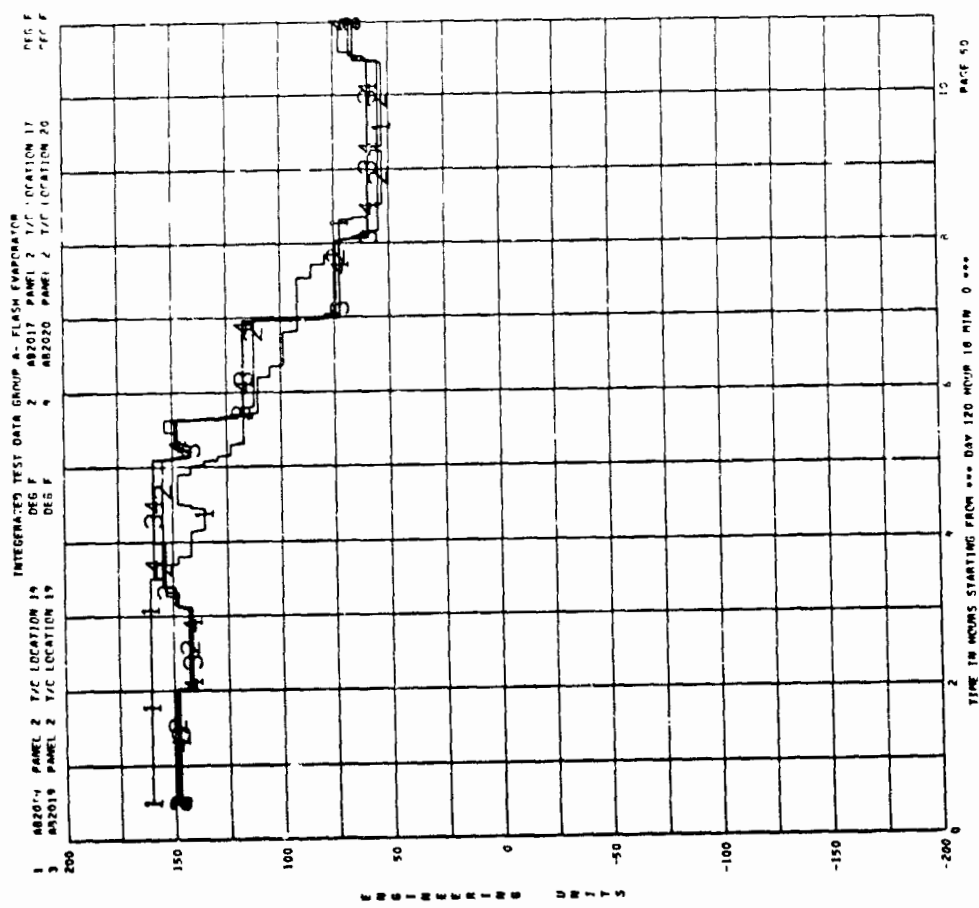
A-45

| INTEGRATED TEST DATA GROUP A- FLASH EVAPORATOR | | | | |
|--|--------|---------|-----------------|-------|
| 1 | AA1011 | PANEL 1 | T/C LOCATION 11 | DEF F |
| 2 | AA1018 | PANEL 1 | T/C LOCATION 18 | DEF F |
| 3 | AA1029 | PANEL 1 | T/C LOCATION 29 | DEF F |
| 1 | AA1011 | PANEL 1 | T/C LOCATION 11 | DEF F |
| 2 | AA1018 | PANEL 1 | T/C LOCATION 18 | DEF F |
| 3 | AA1029 | PANEL 1 | T/C LOCATION 29 | DEF F |

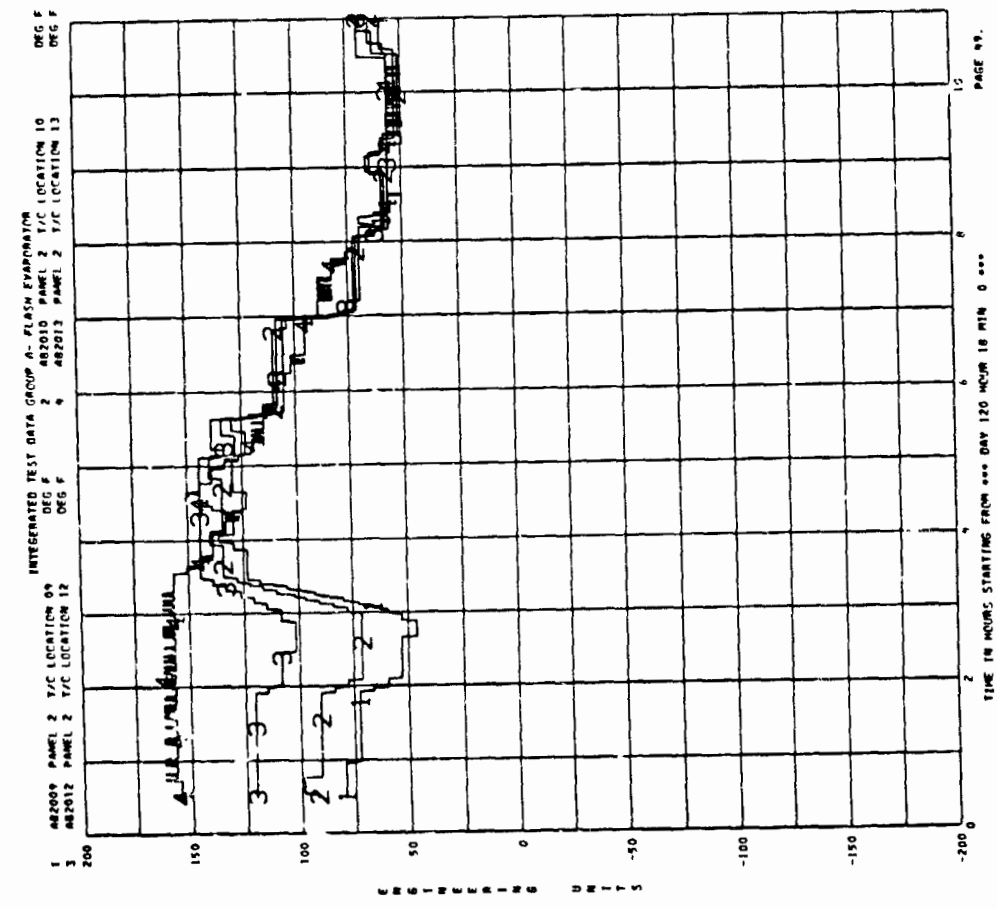


A-46

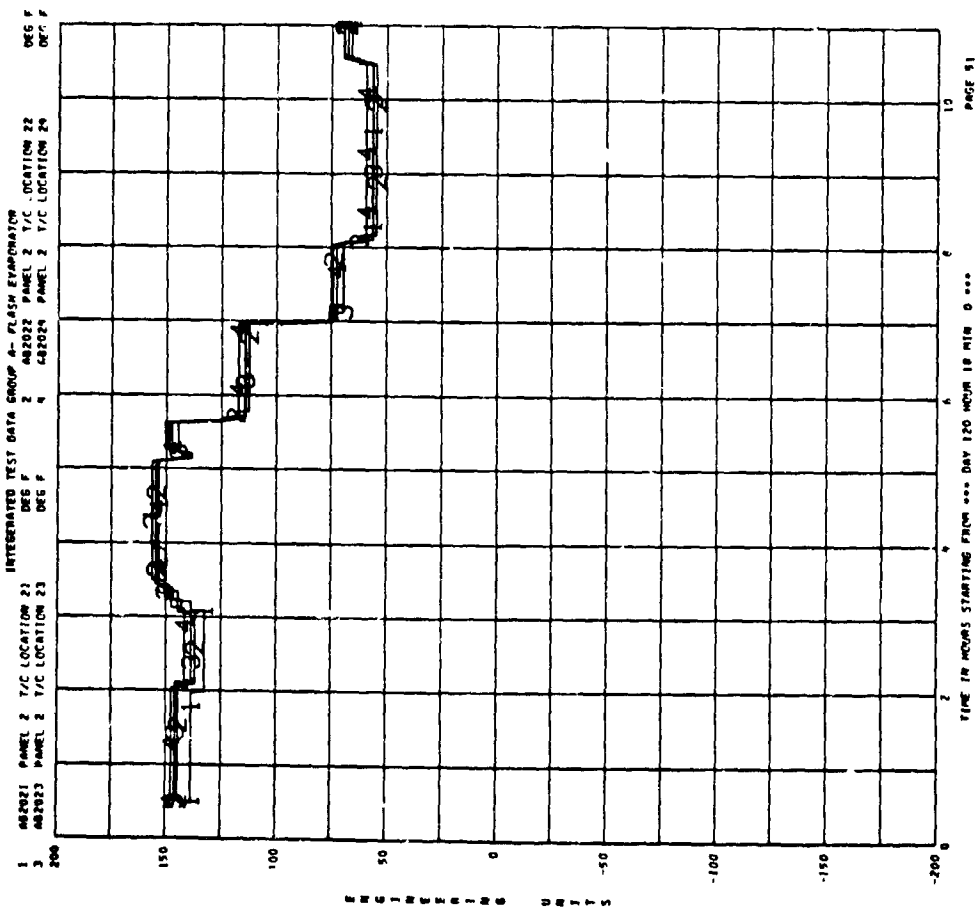




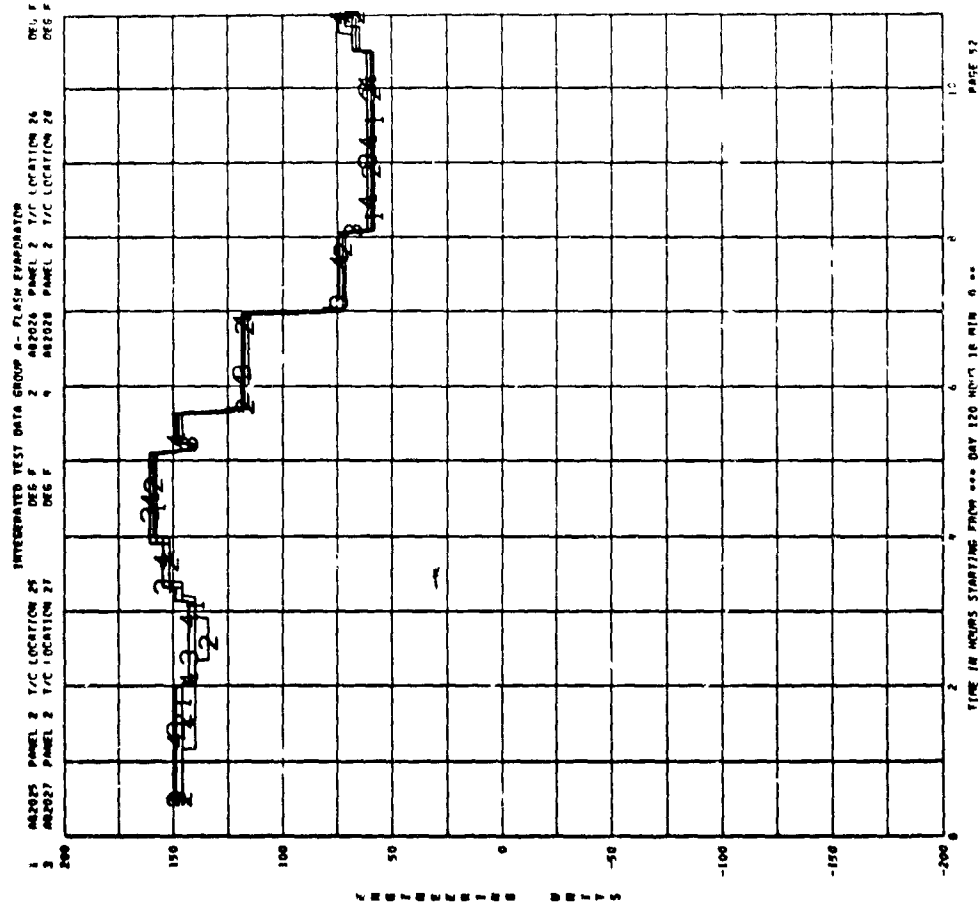
A-50



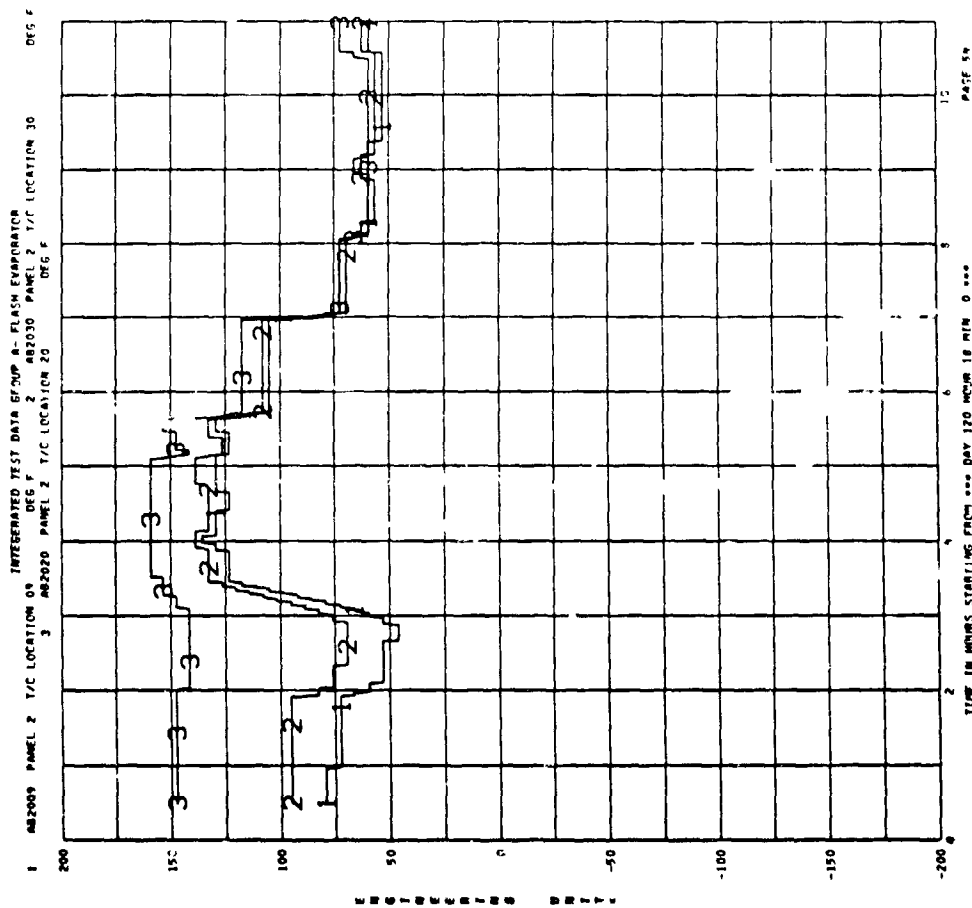
A-49



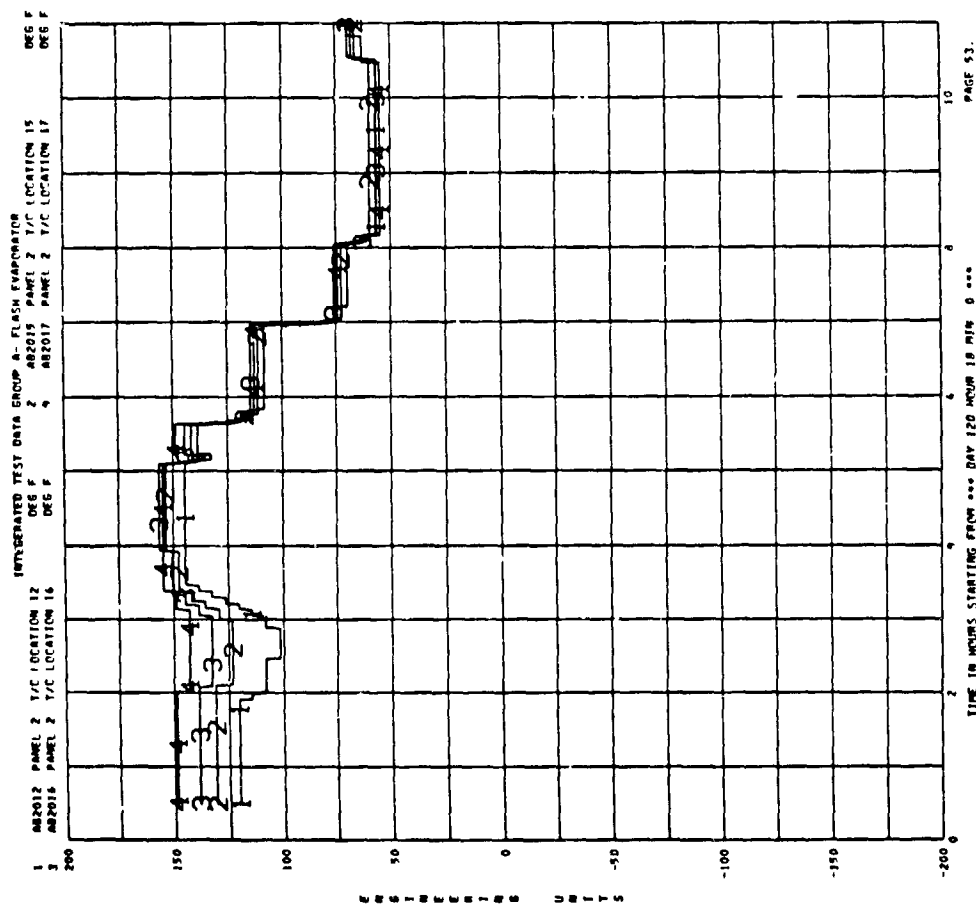
A-51



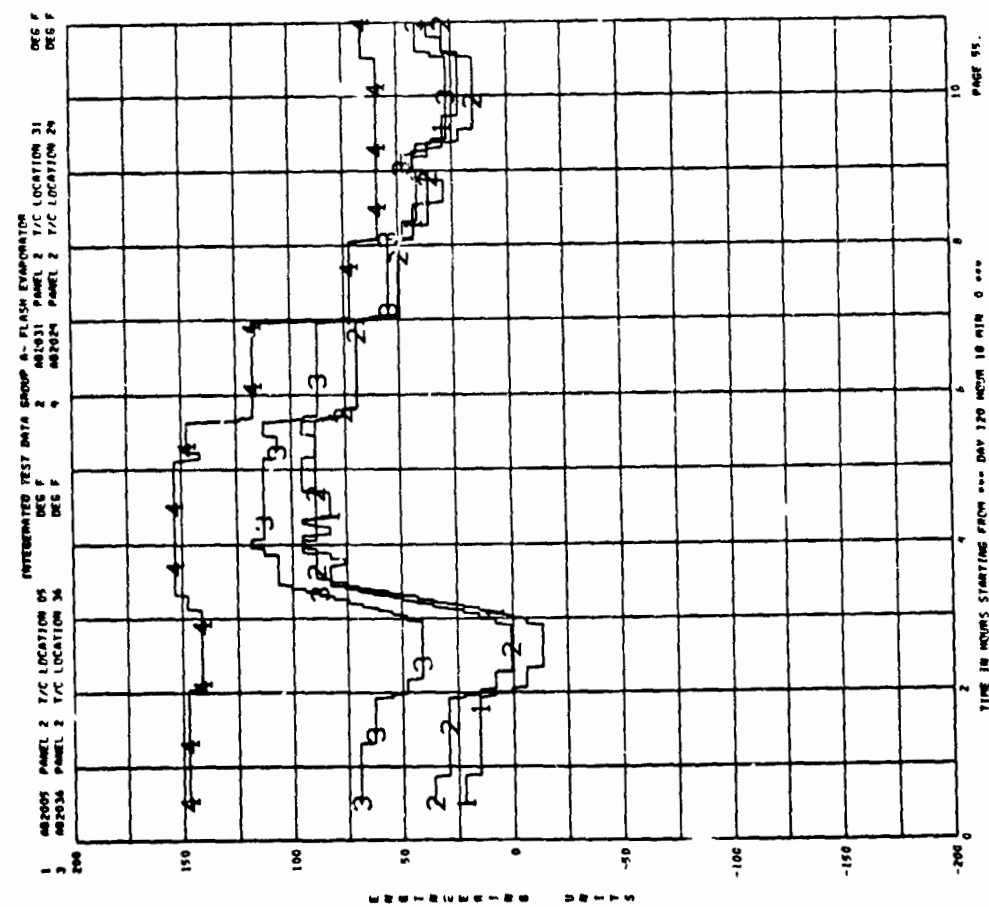
A-52



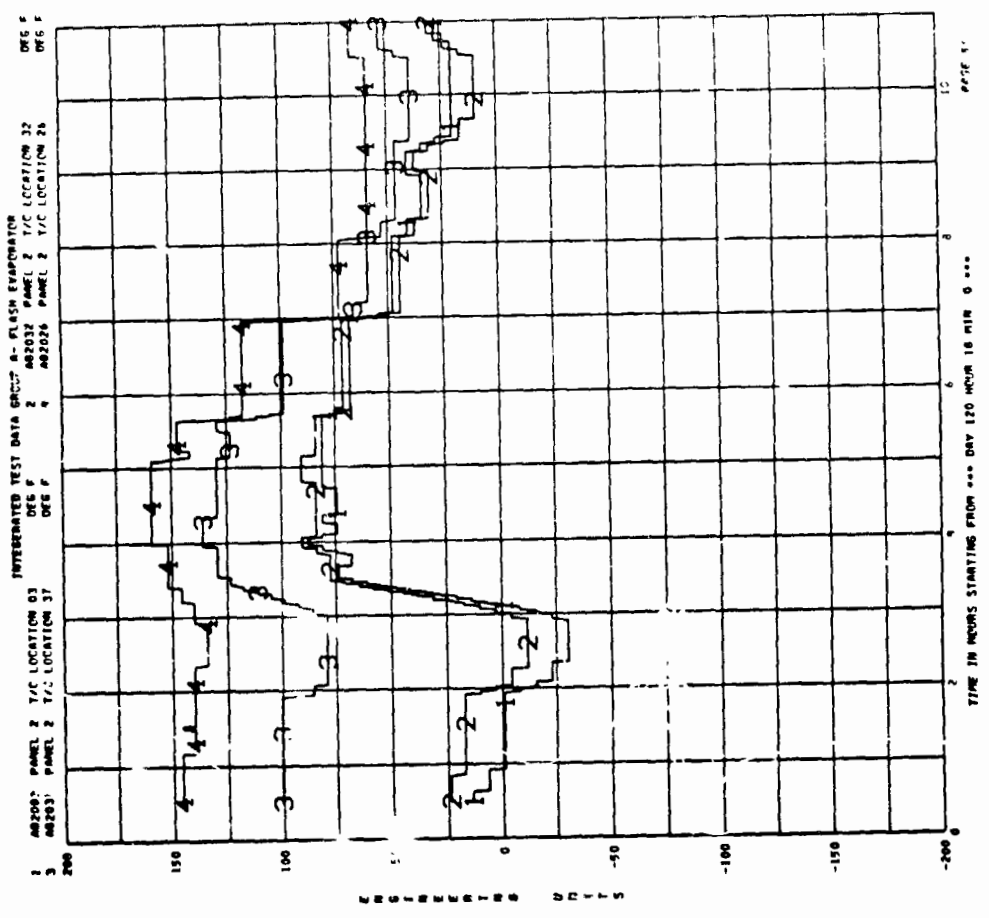
A-54



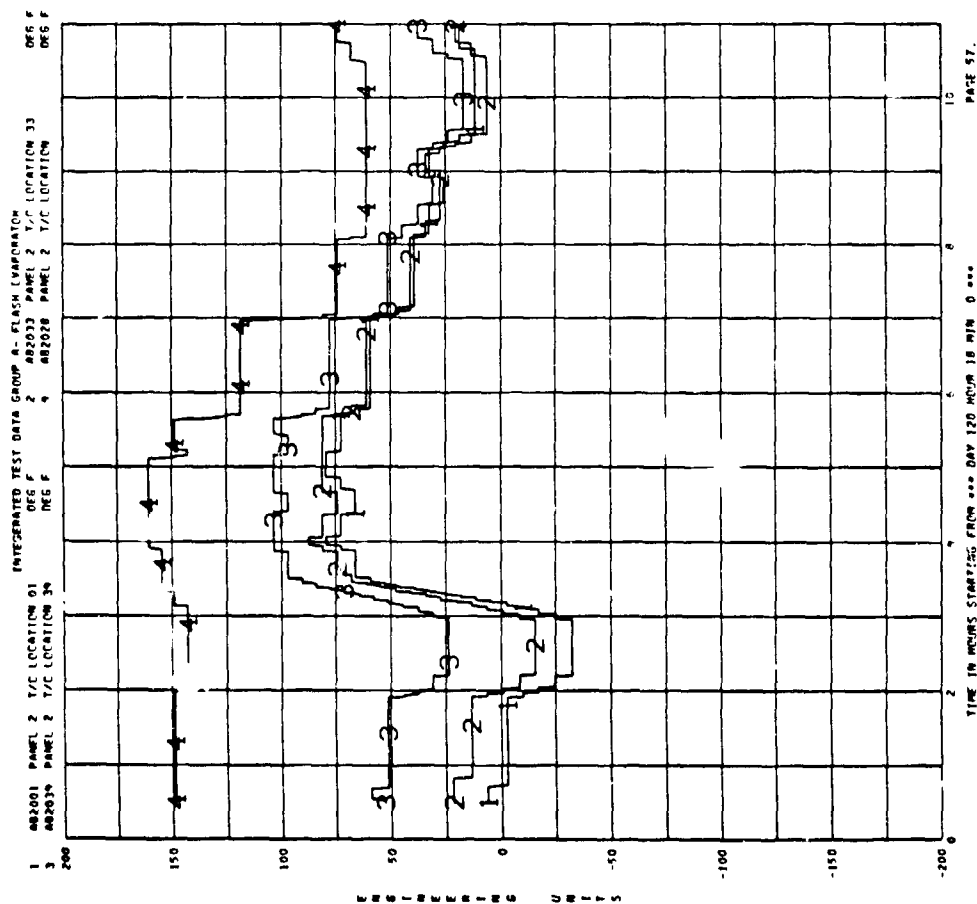
A-53



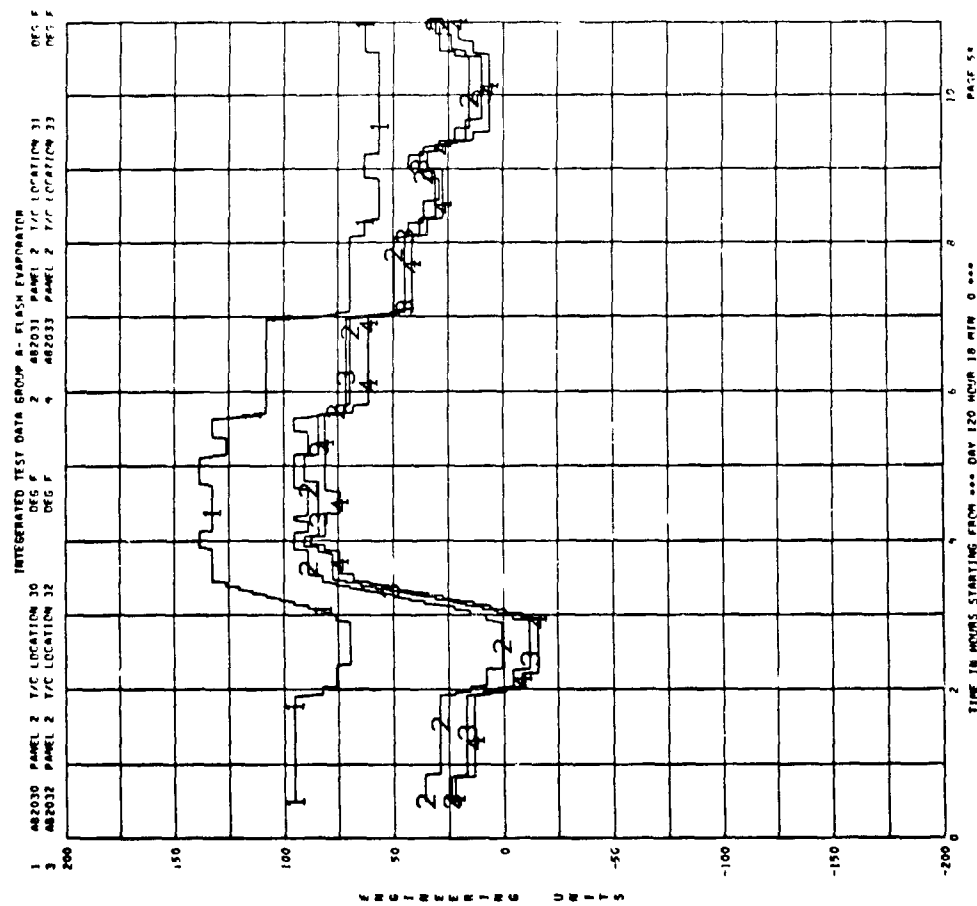
A-55



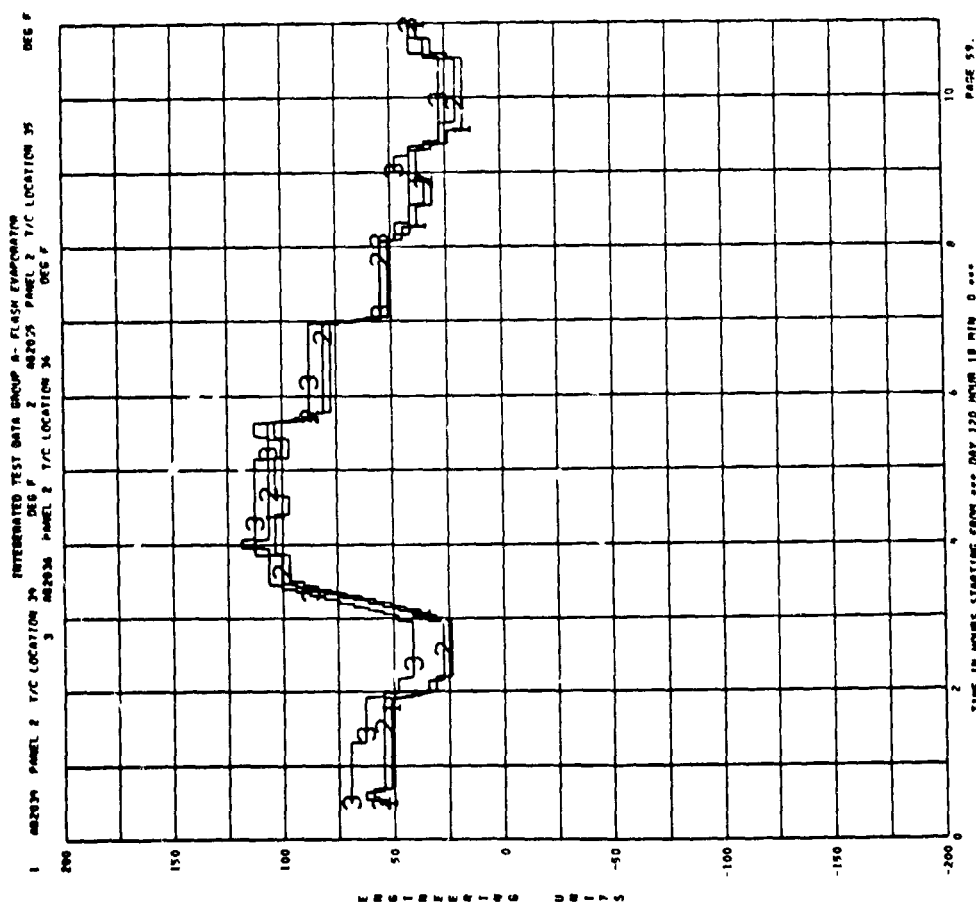
A-56



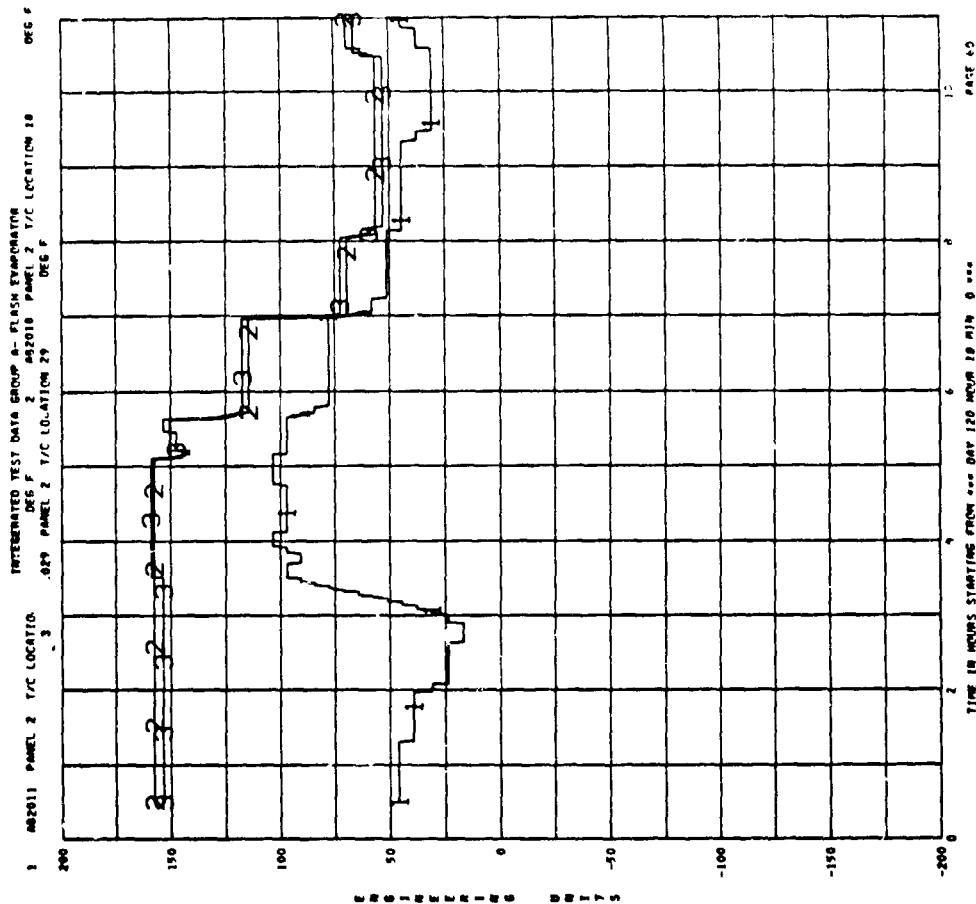
A-57



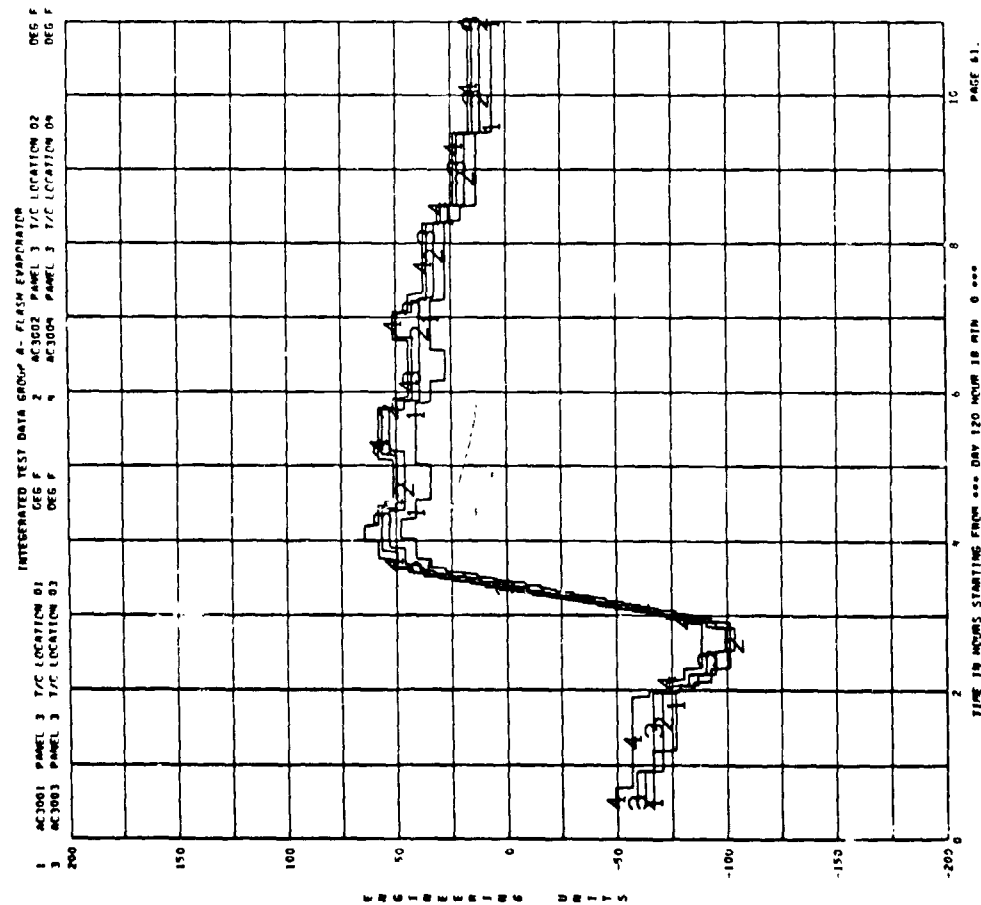
A-58



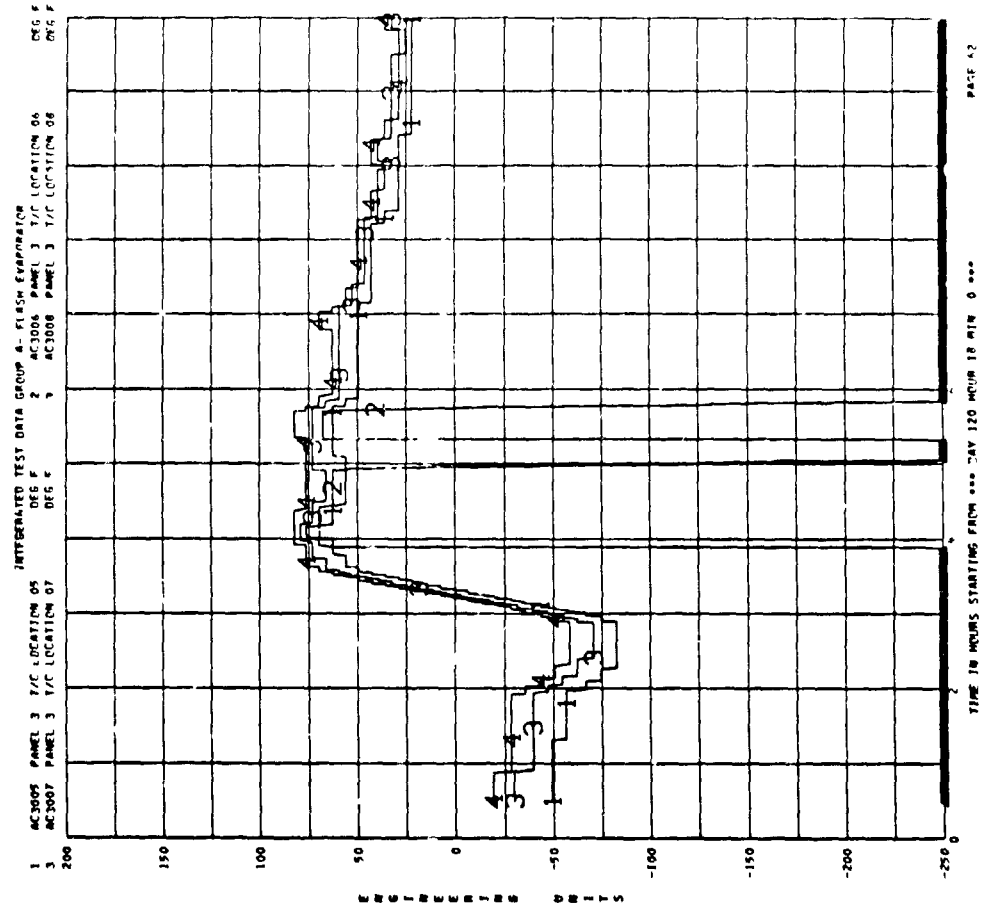
A-59



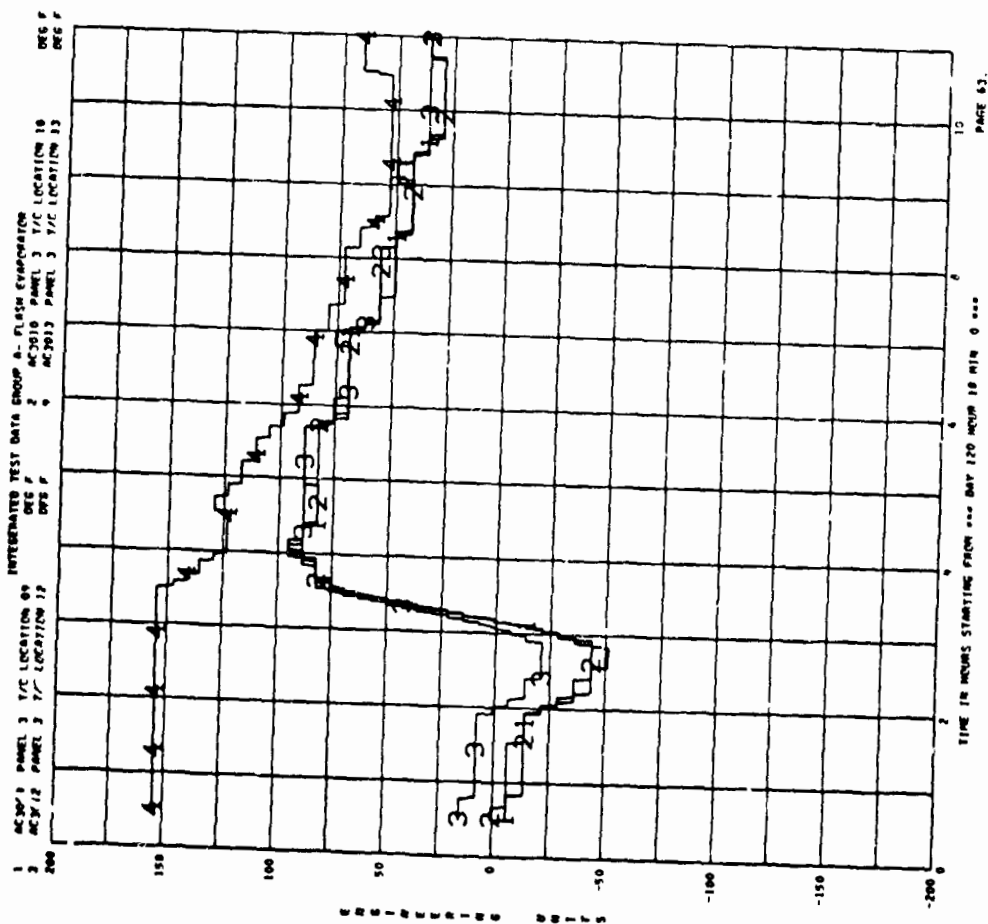
A-60



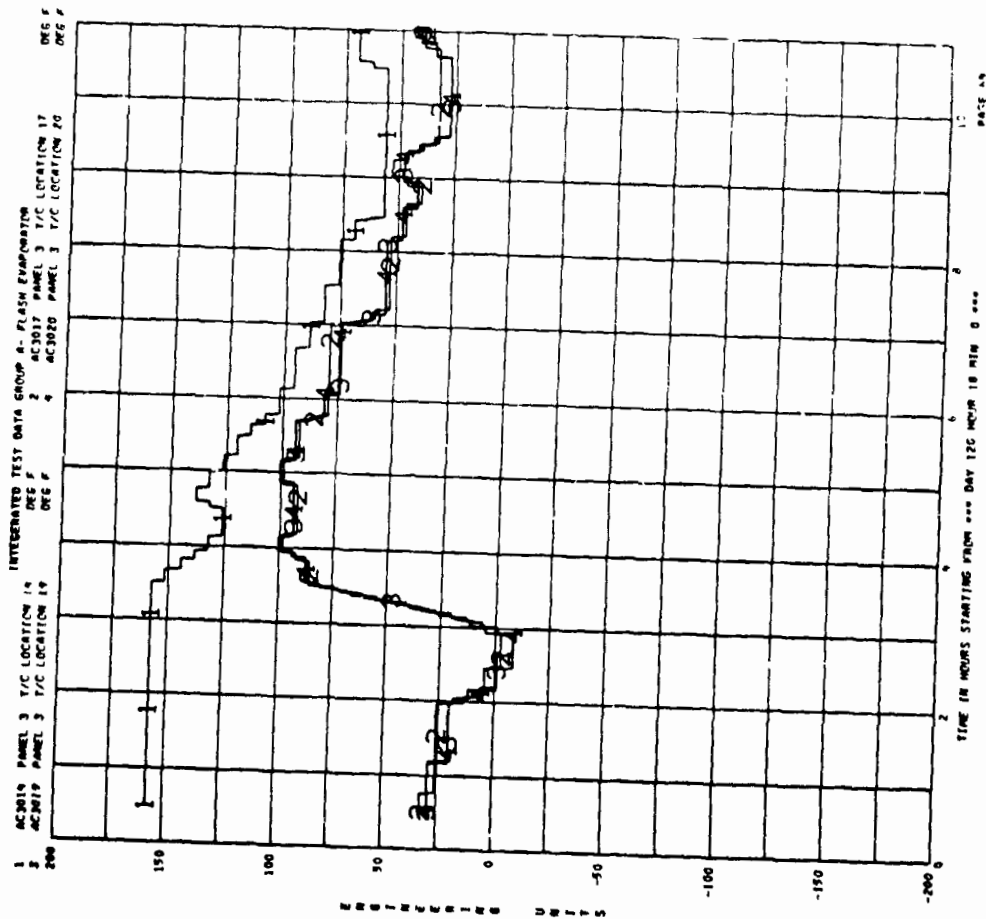
A-61



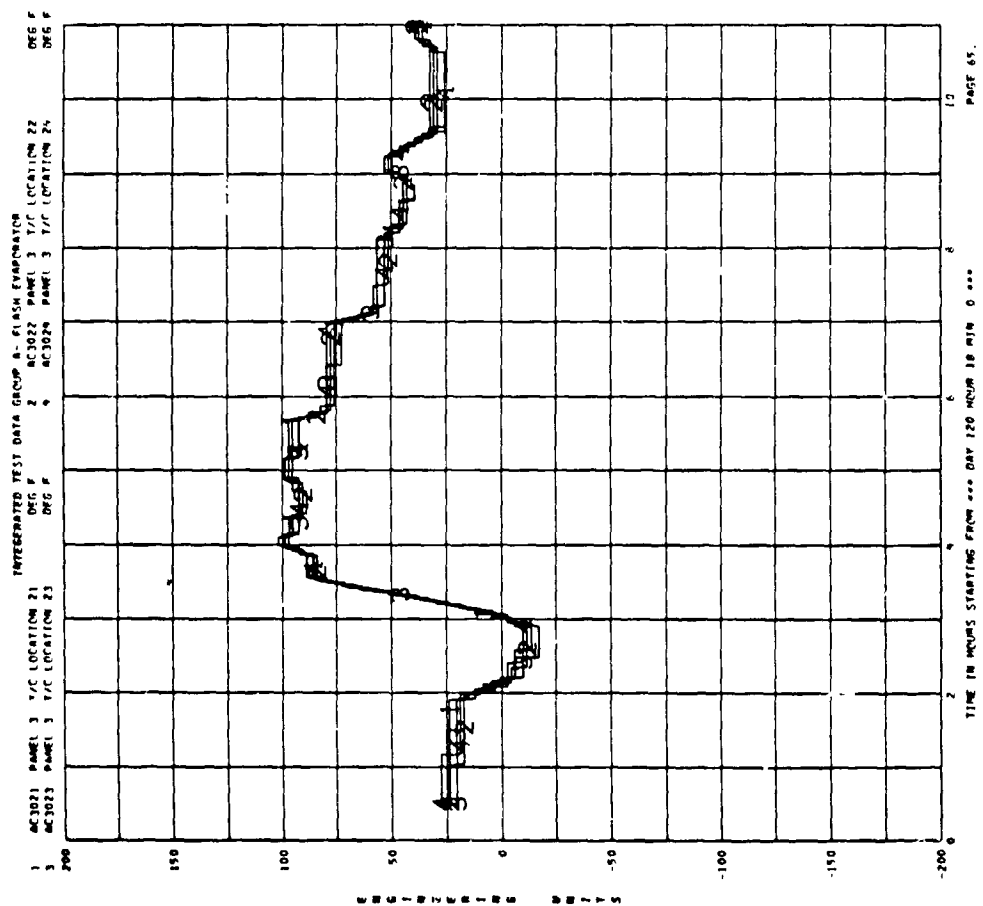
A-62



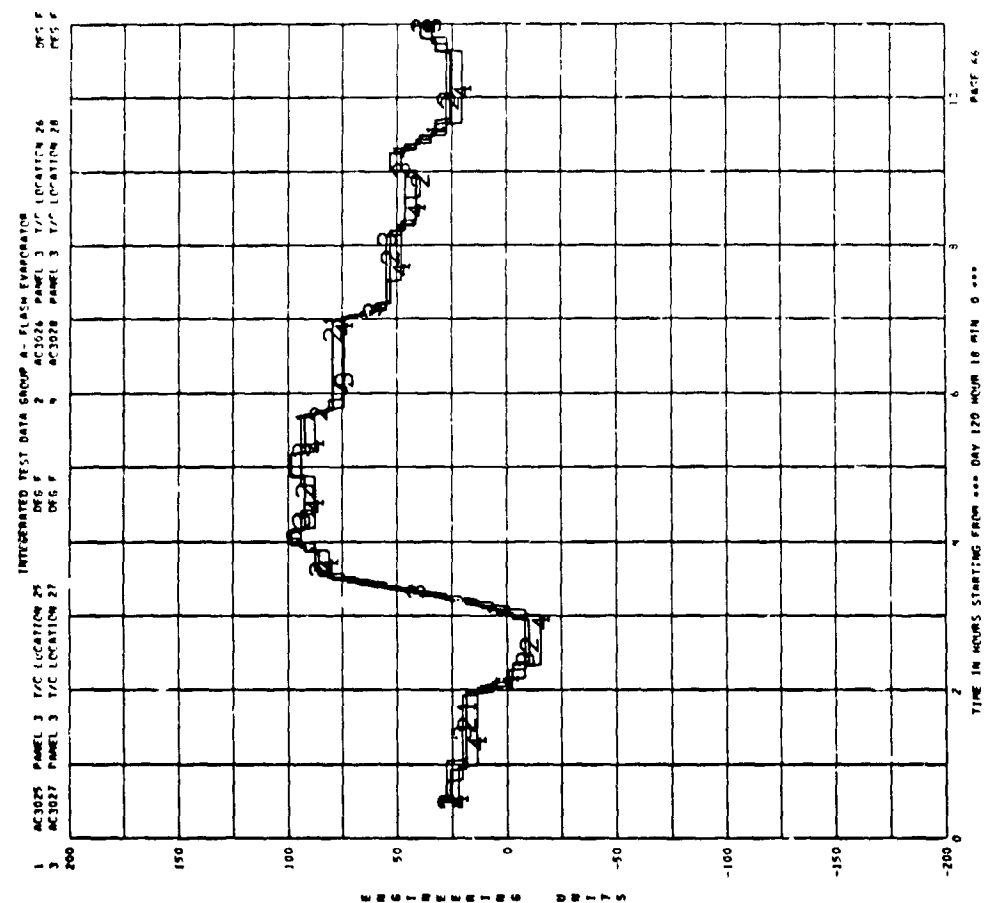
A-63



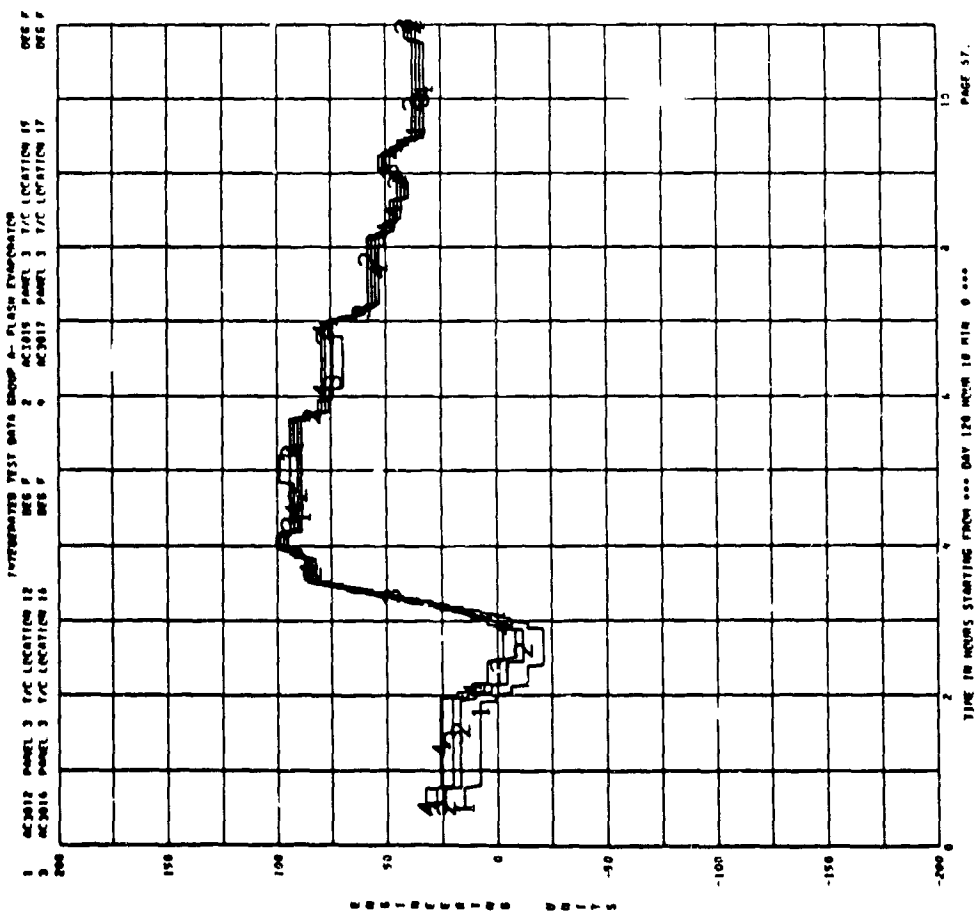
A-64



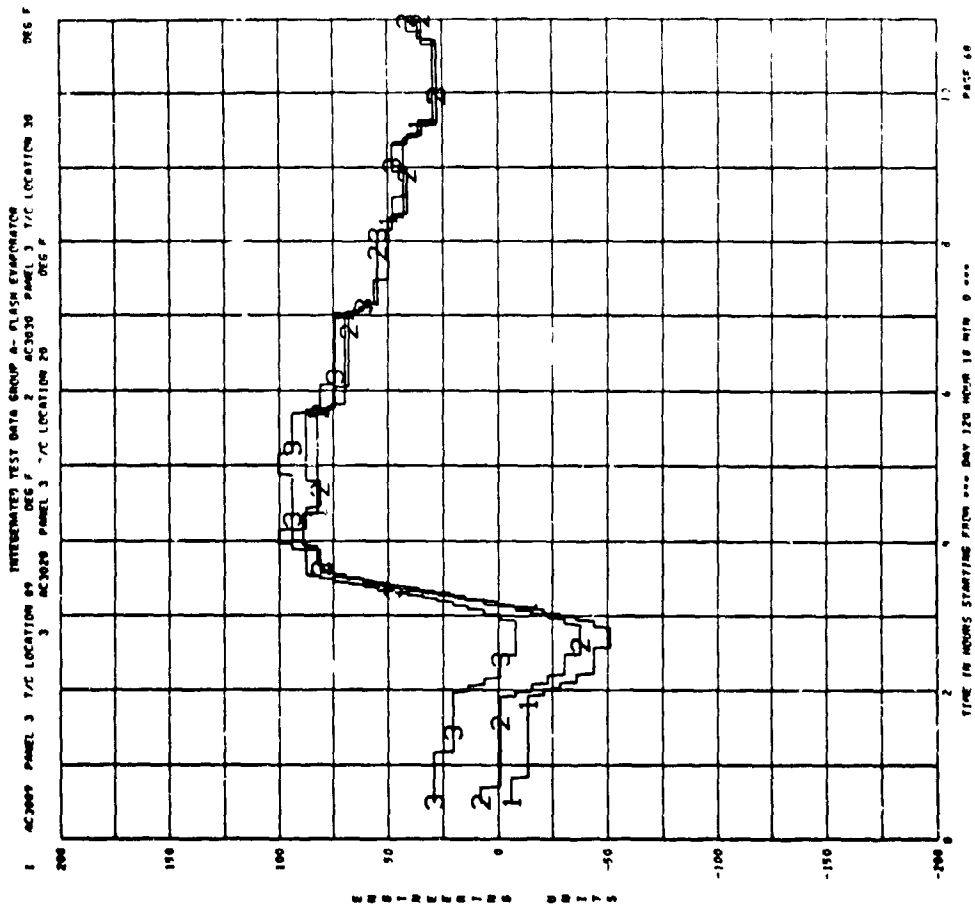
A-65



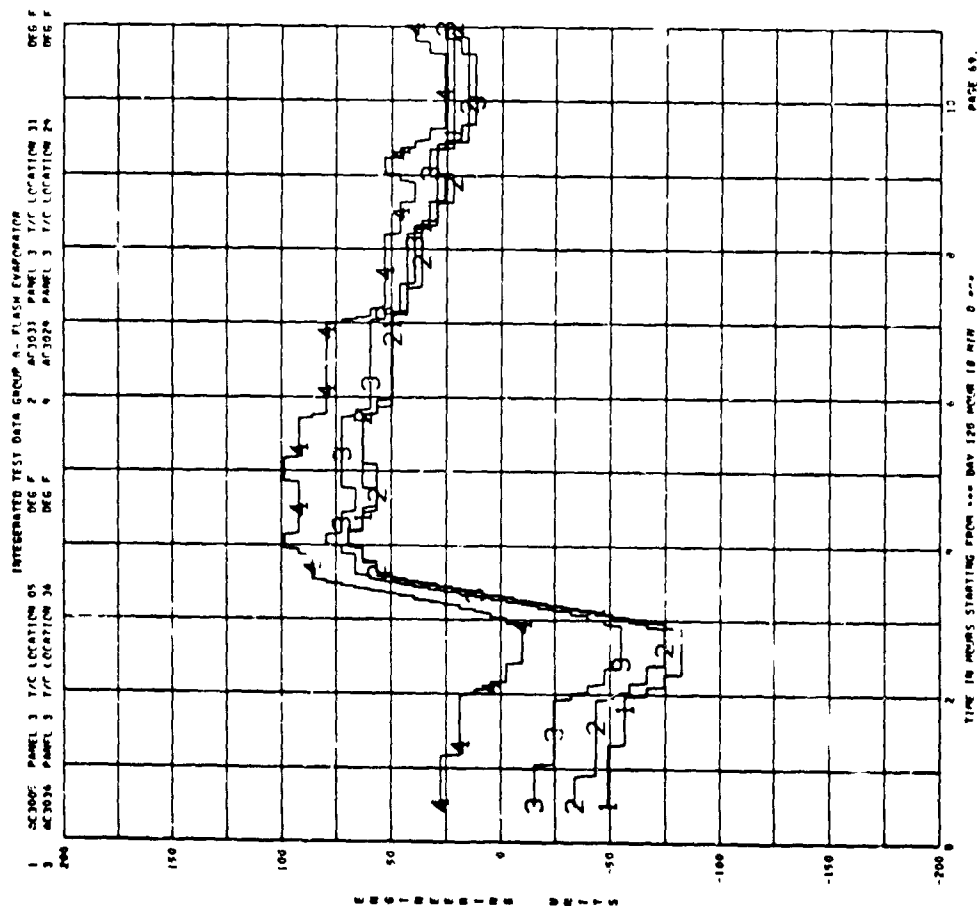
A-66



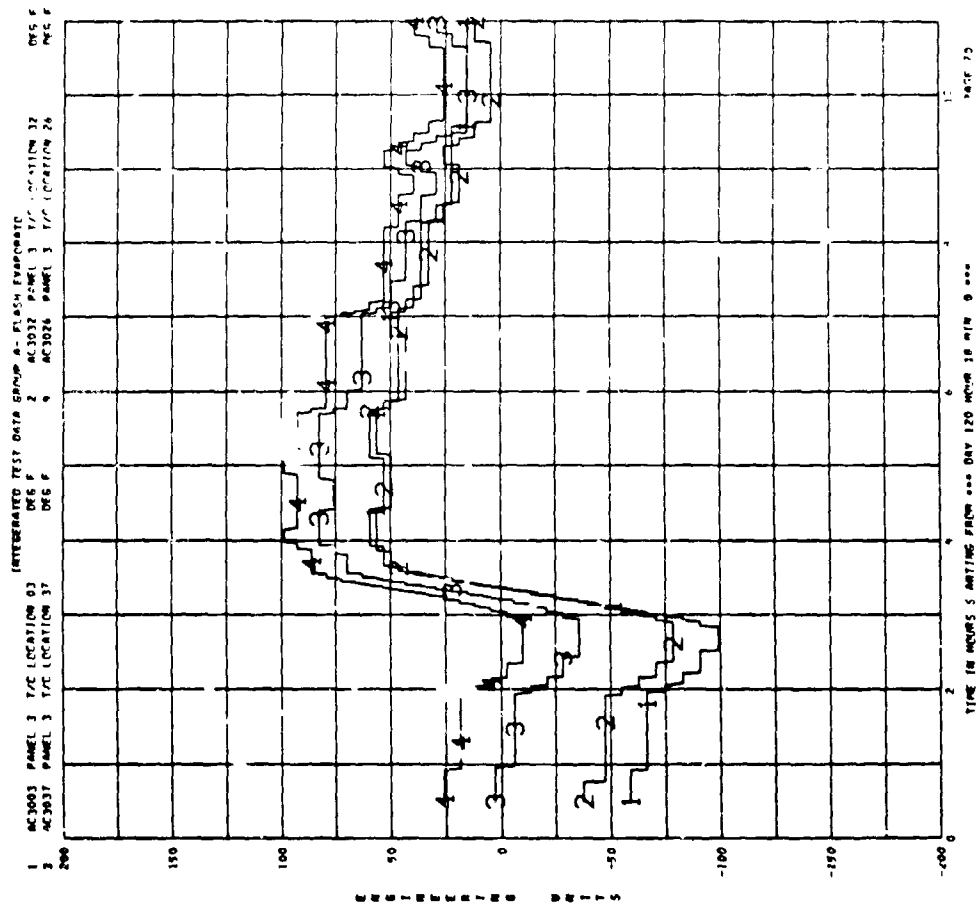
A-67



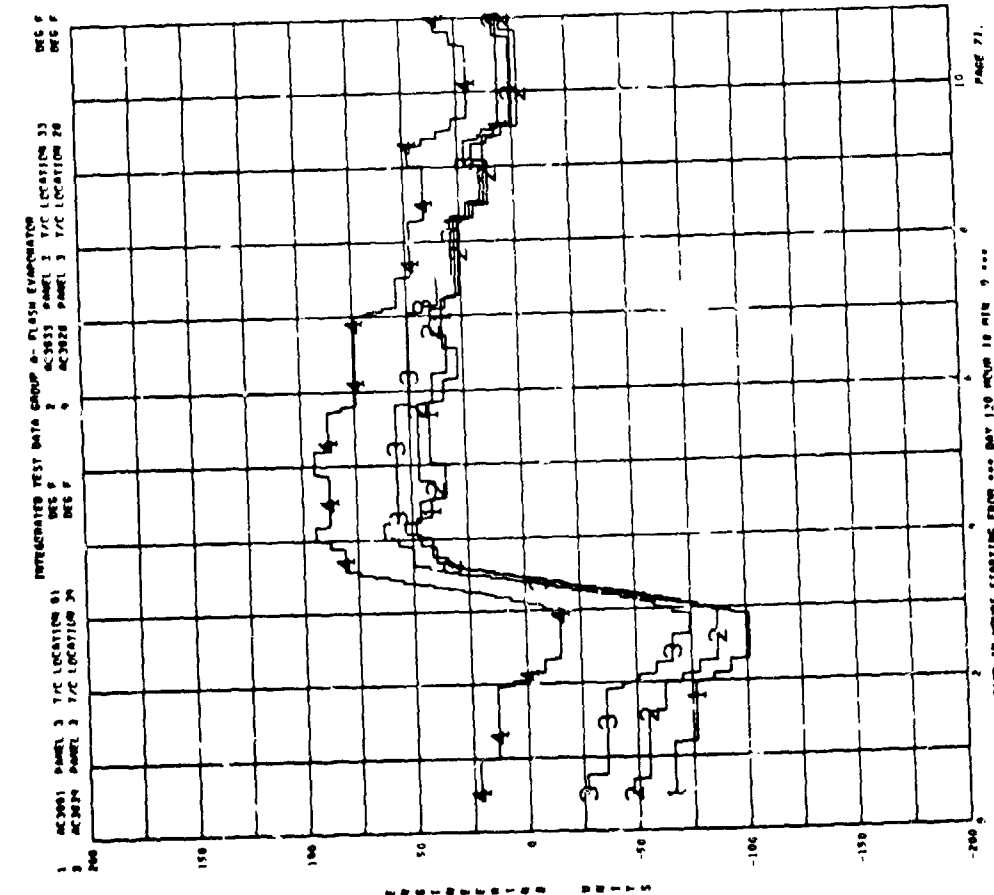
A-68



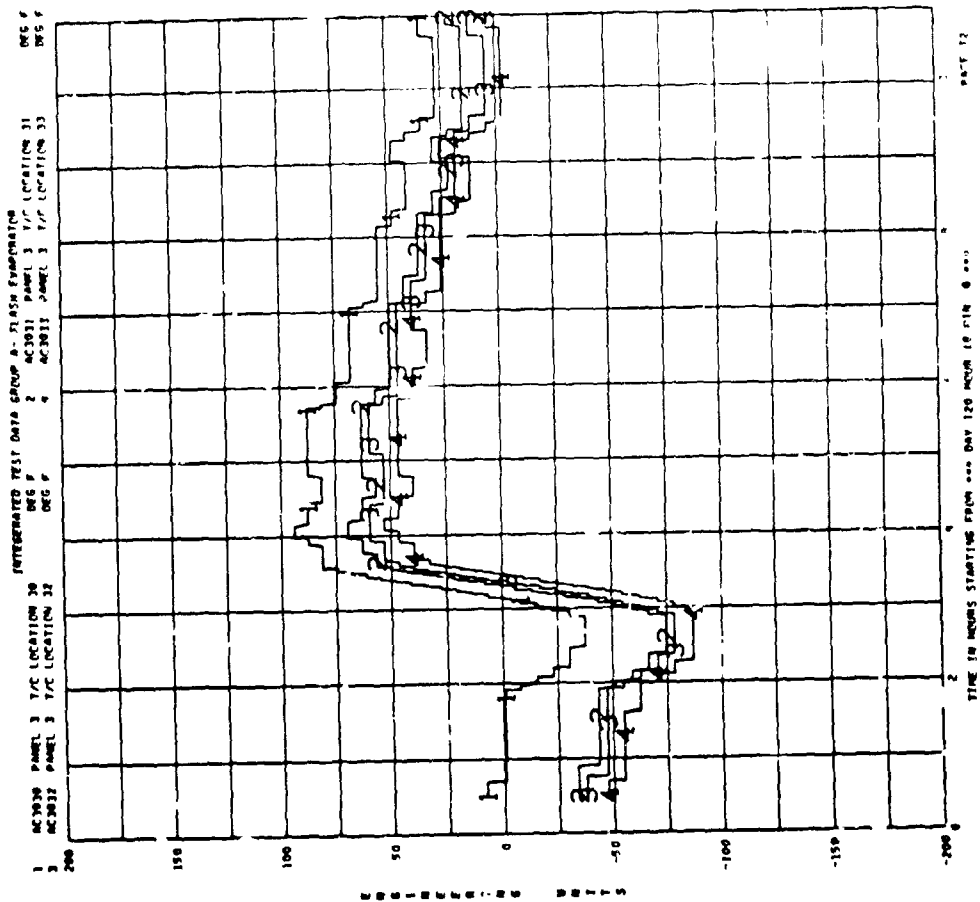
A-69



A-70

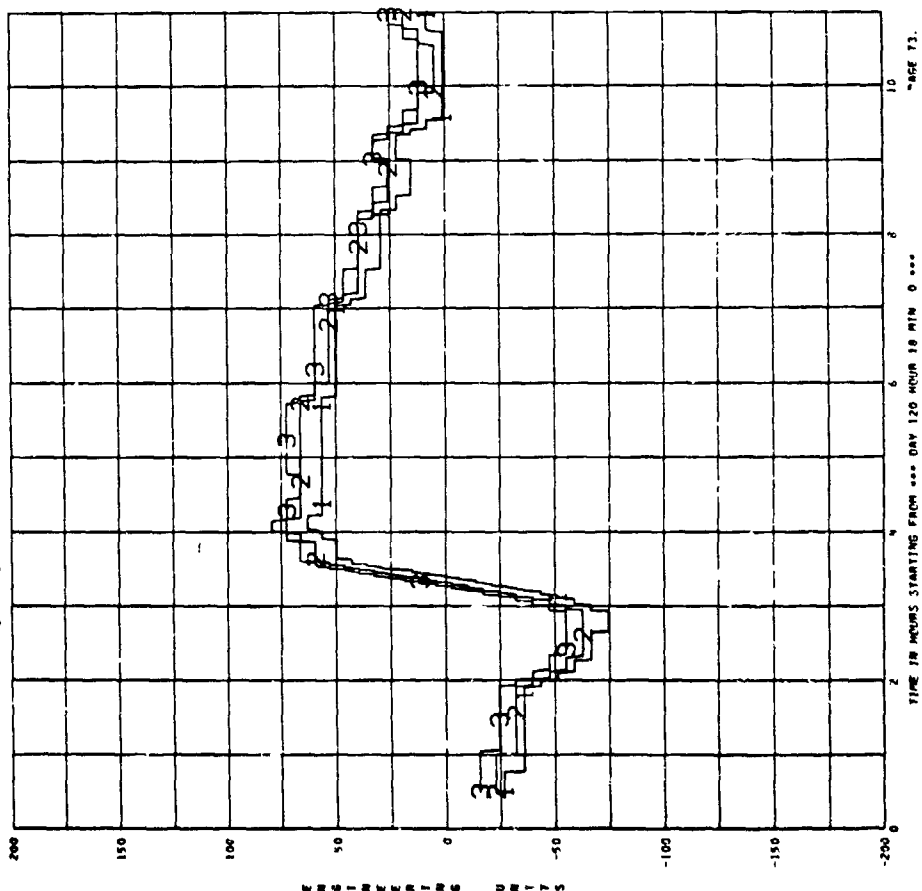


A-71



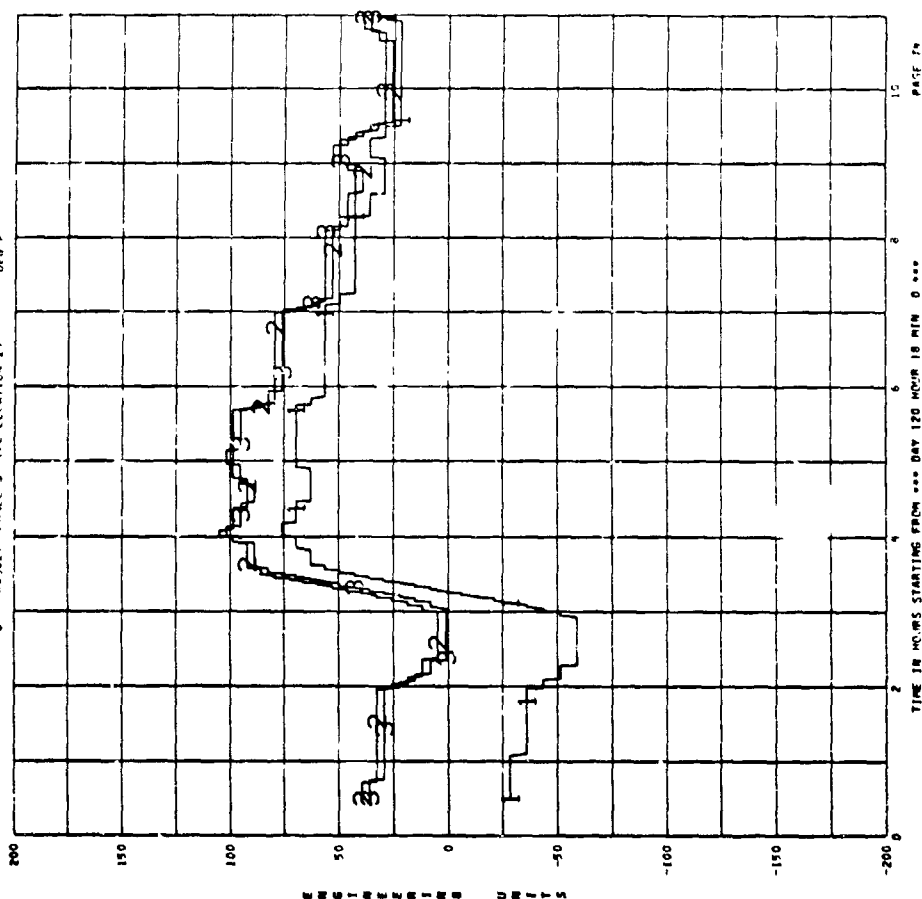
A-72

| INTEGRATED TEST DATA GROUP A- FLASH EVAPORATOR | | | | |
|--|--------|---------|-----------------|-----------------|
| | AC3034 | PANEL 1 | T/C LOCATION 19 | DES F |
| 1 | AC3034 | PANEL 1 | T/C LOCATION 19 | DES F |
| | | | 2 | AC3035 |
| | | | 3 | AC3036 |
| | | | | PANEL 3 |
| | | | | T/C LOCATION 36 |
| | | | | DES F |
| | | | | DES F |

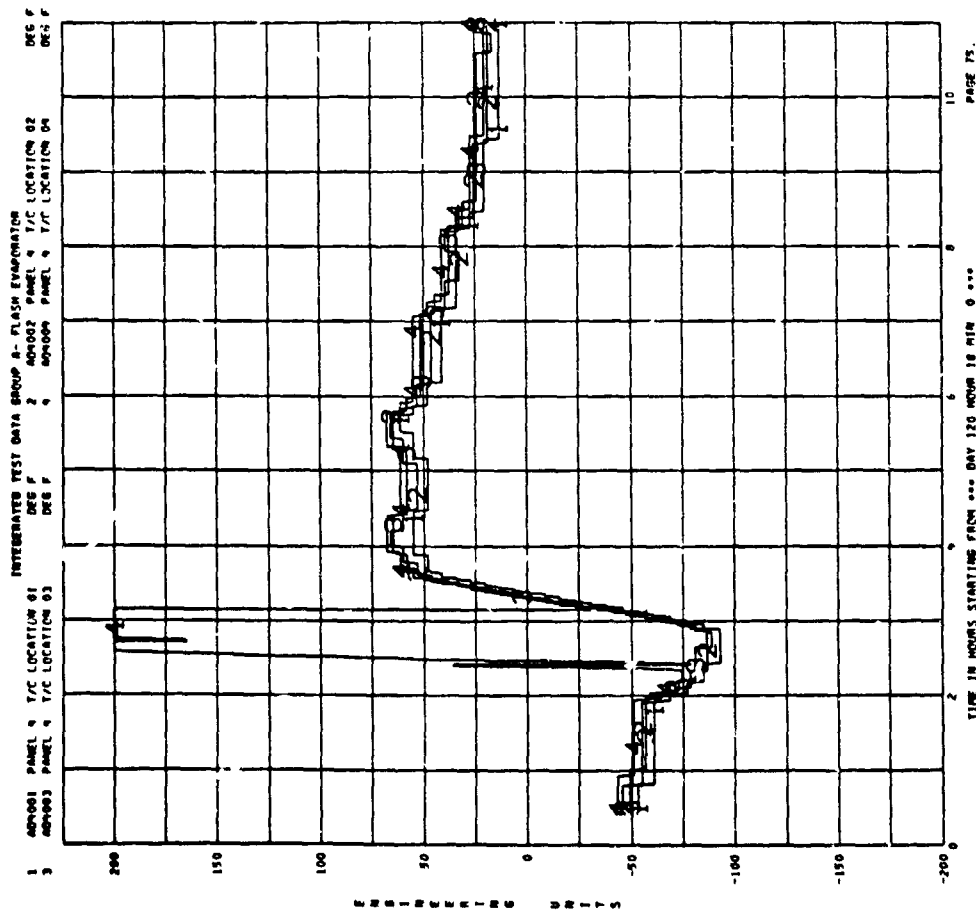


A-73

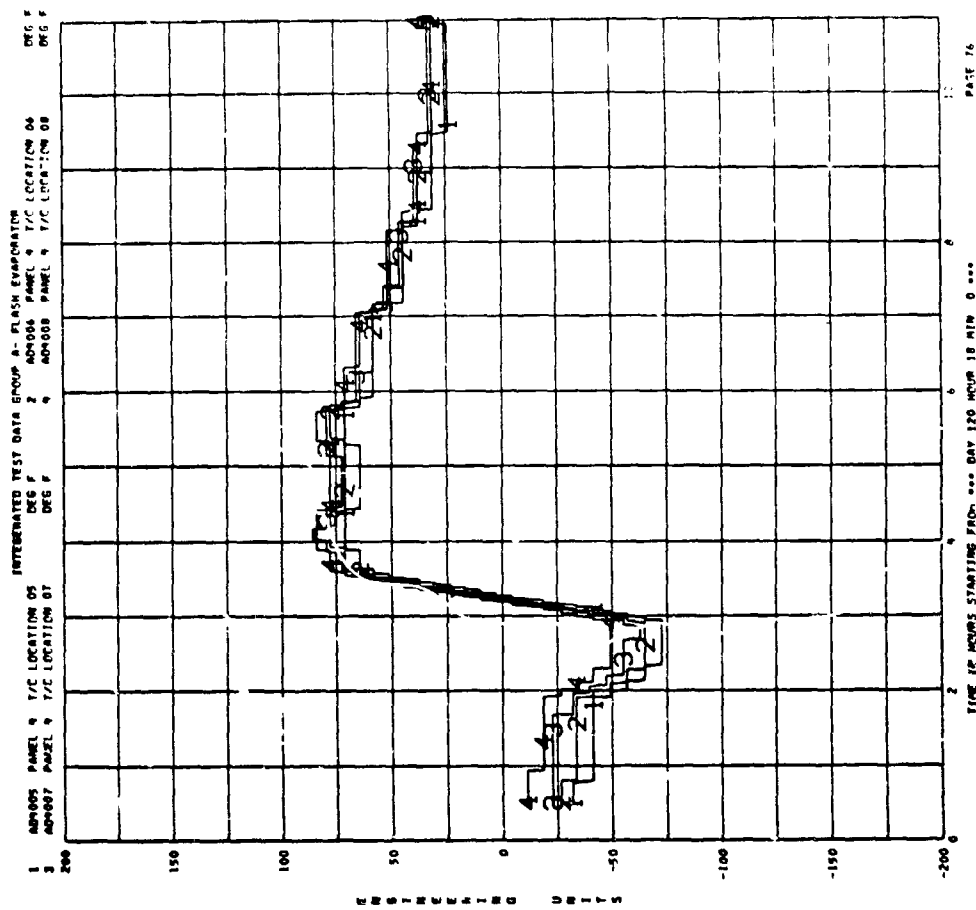
| INTEGRATED TEST DATA SUMMARY - FLASH EVAPORATION | | | |
|--|---------|-----------------|-------|
| 1 | 2 | 3 | 4 |
| AC3011 | PANEL 3 | T/C LOCATION 11 | DFG F |
| AC3012 | PANEL 3 | T/C LOCATION 10 | DFG F |
| AC3024 | PANEL 3 | T/C LOCATION 29 | DFG F |



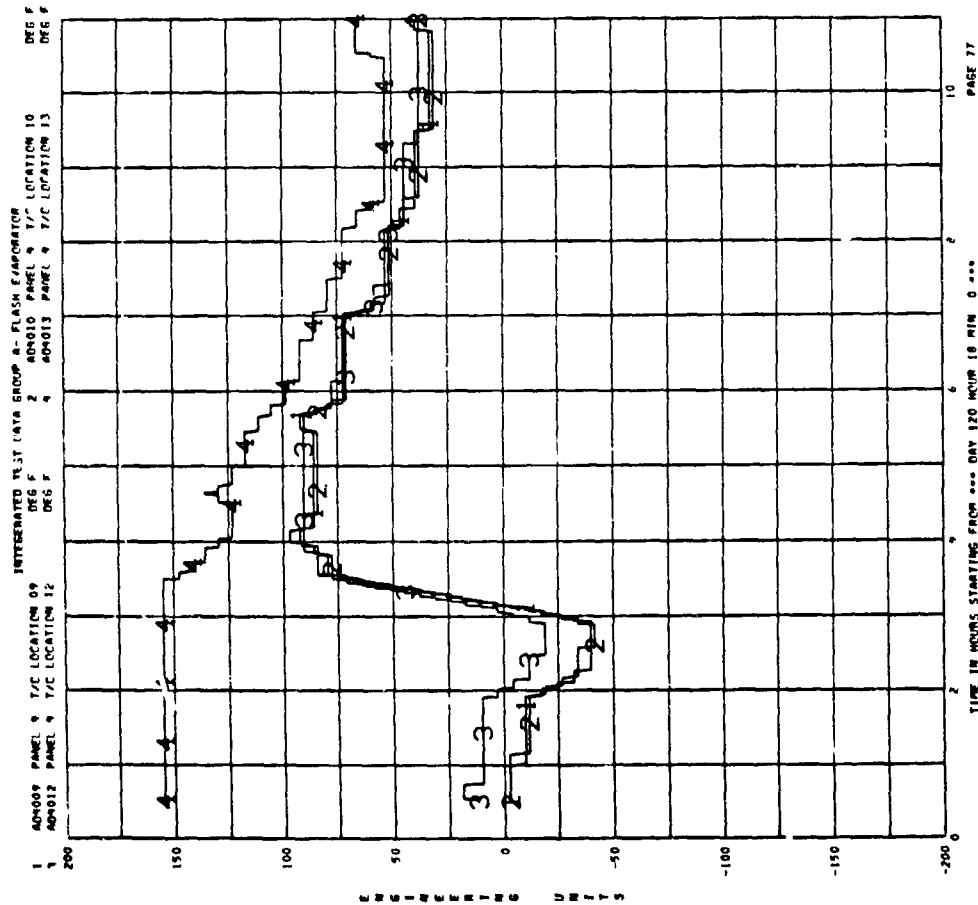
A-74



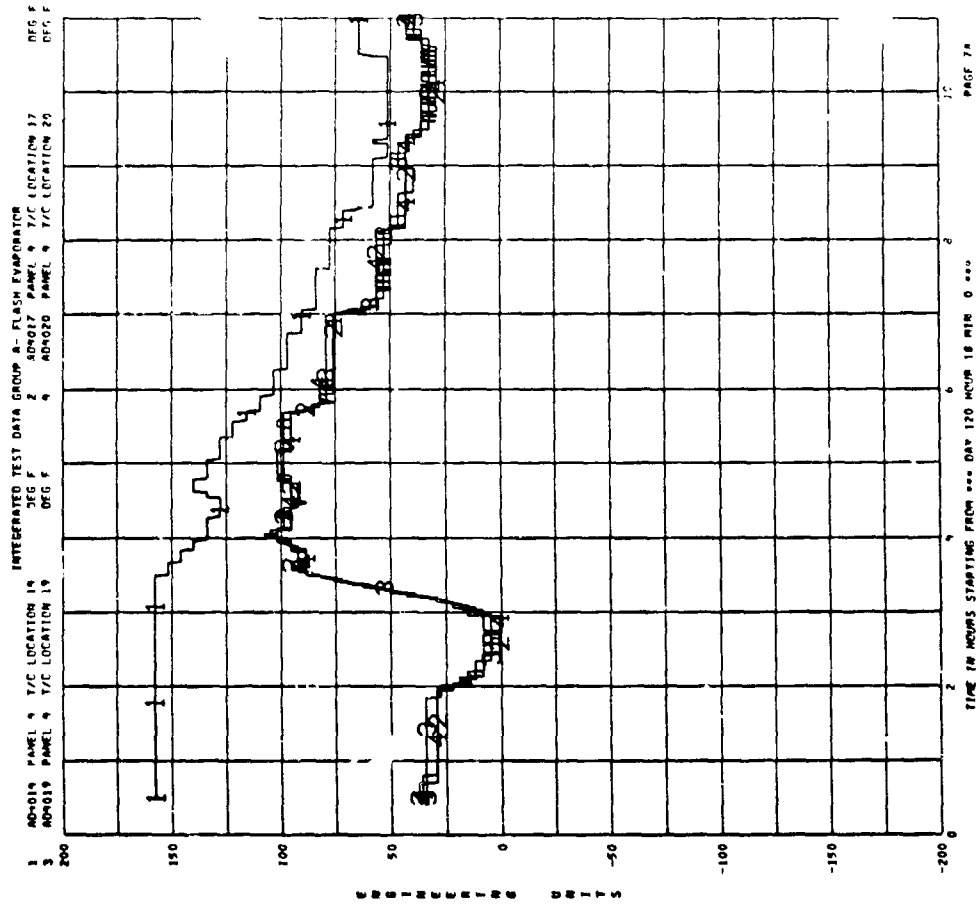
A-75



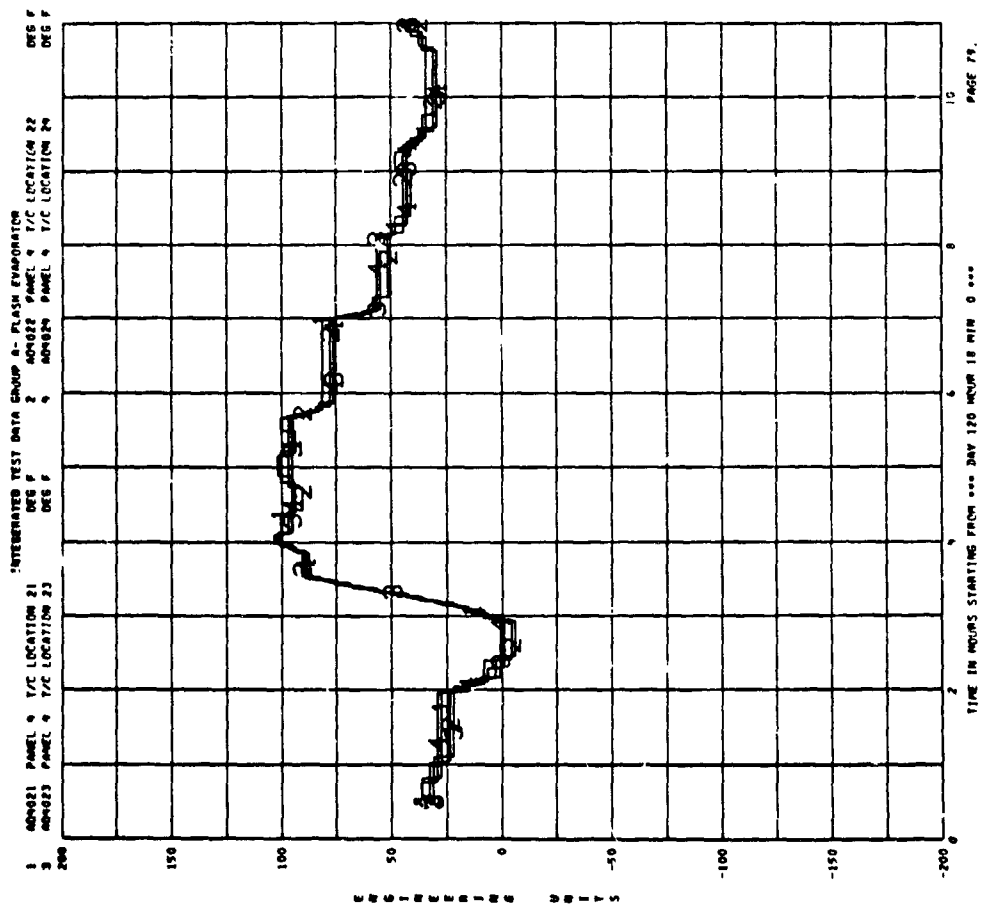
A-76



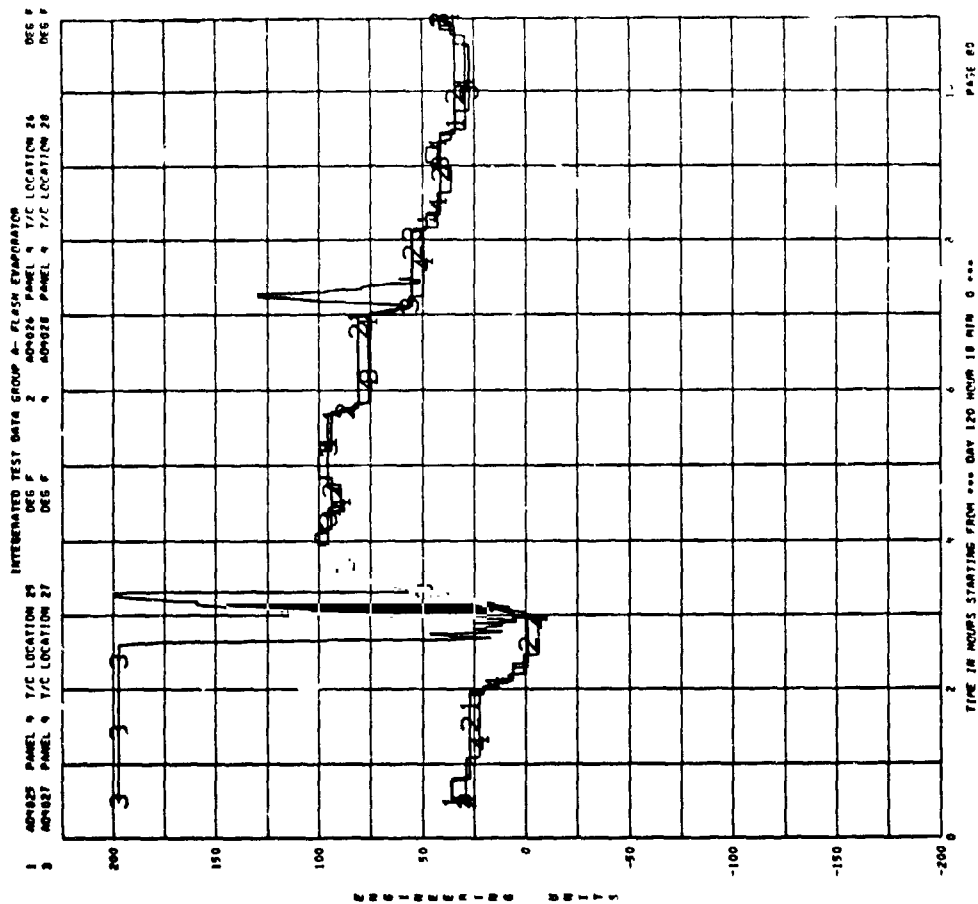
A-77



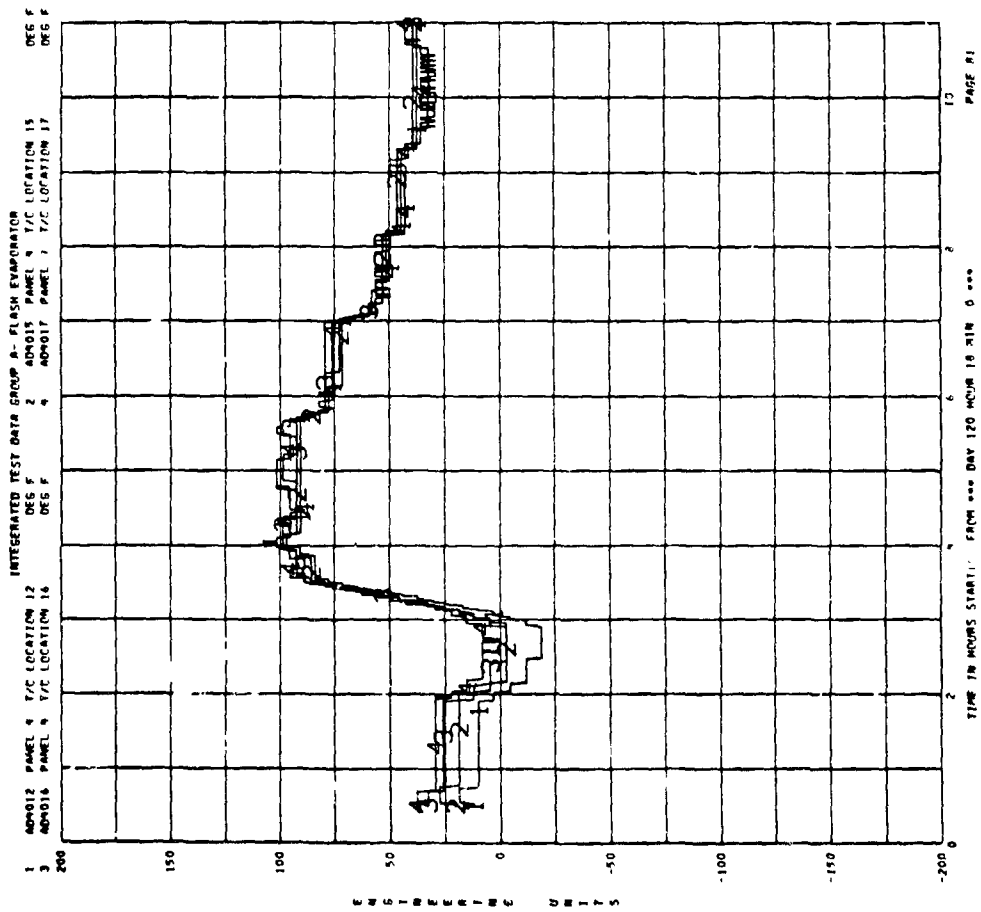
A-78



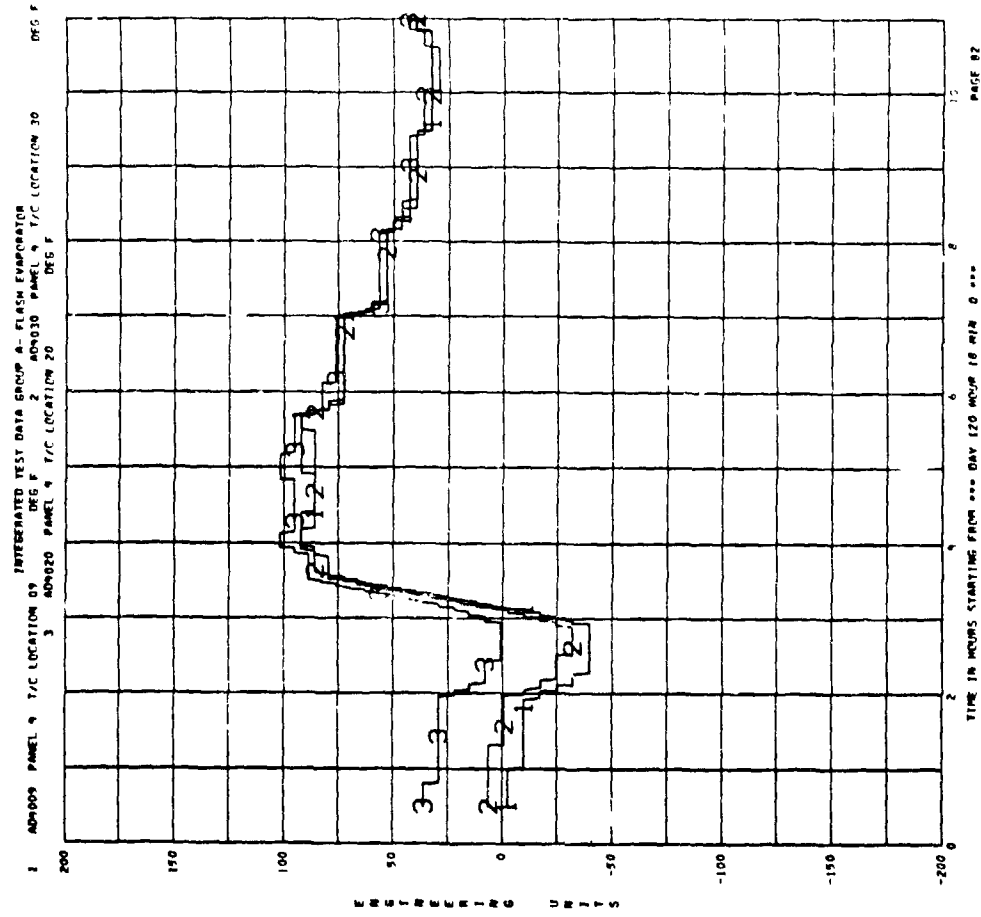
A-79



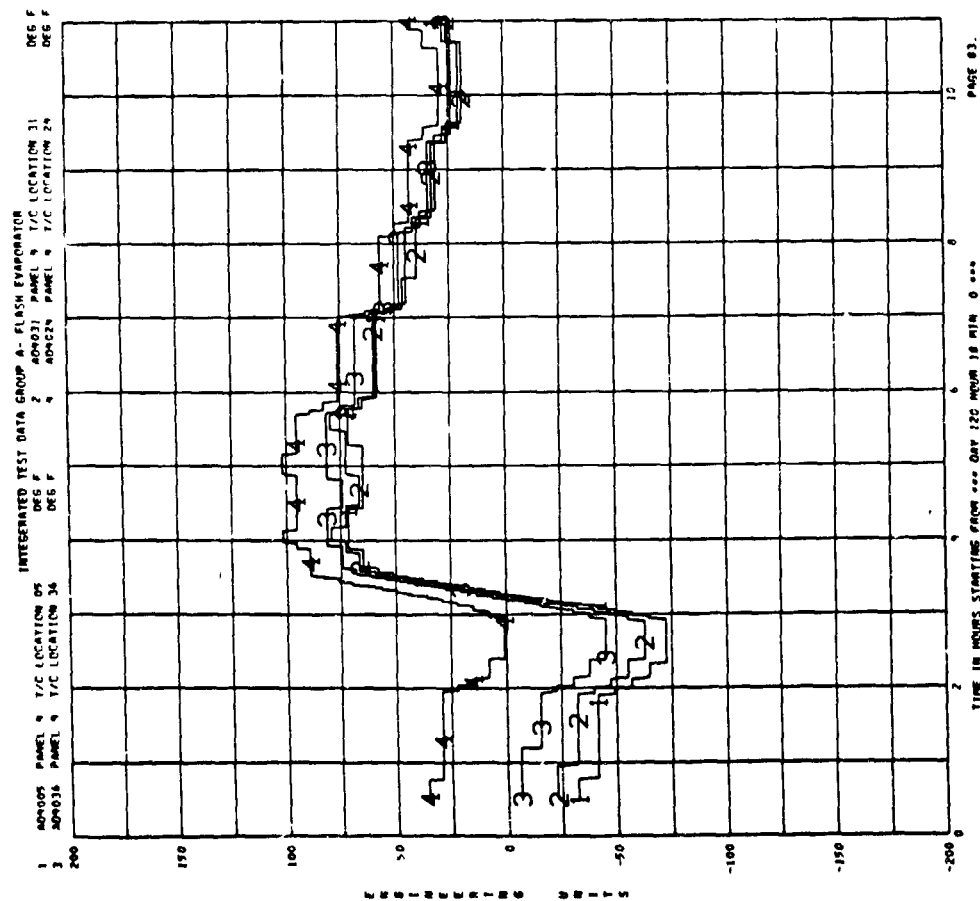
A-80



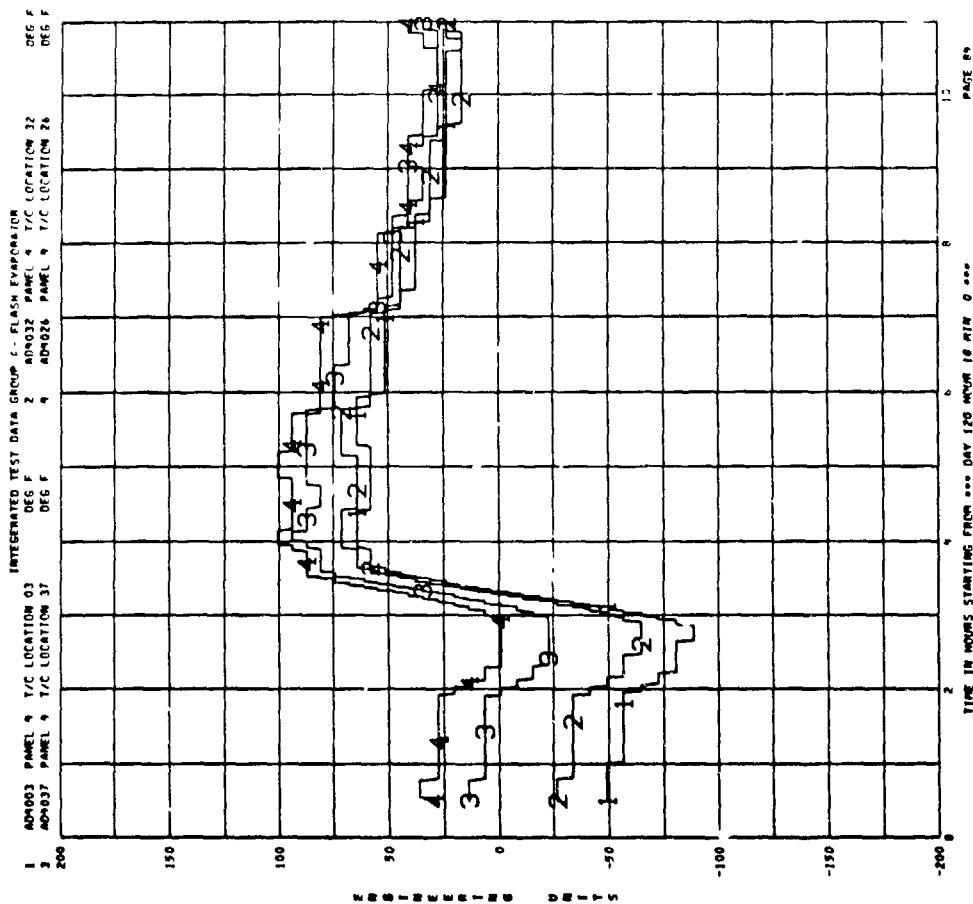
A-81



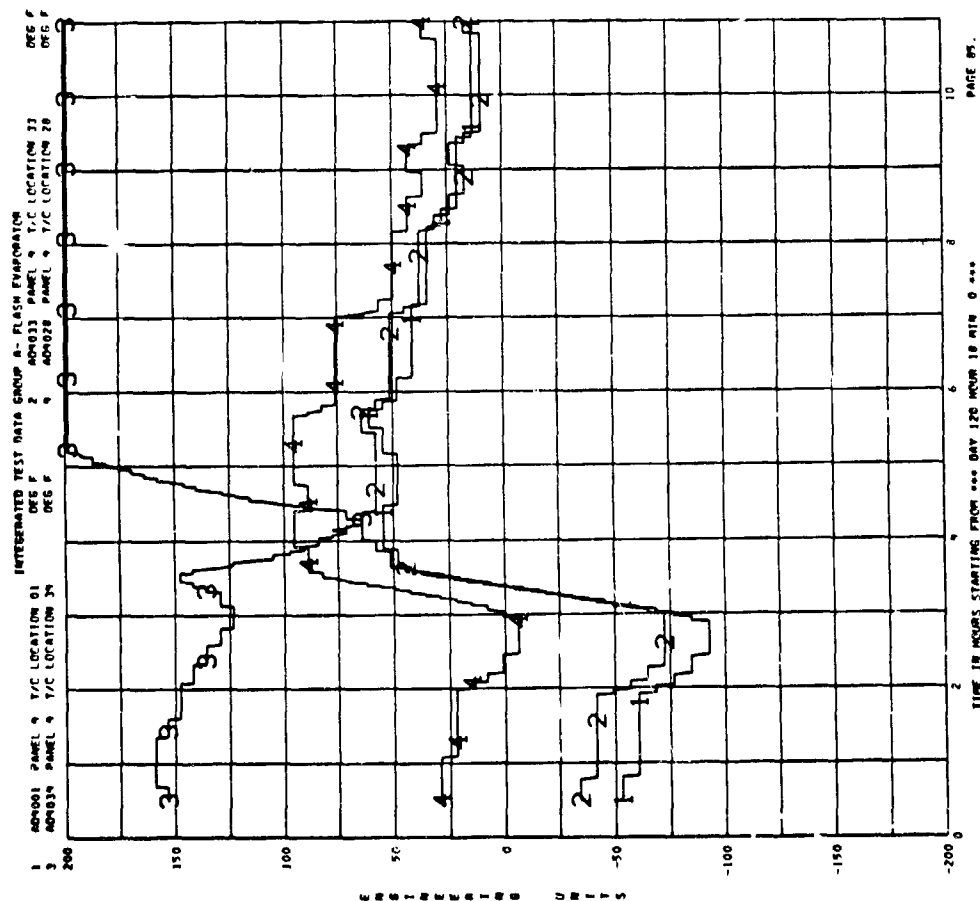
A-82



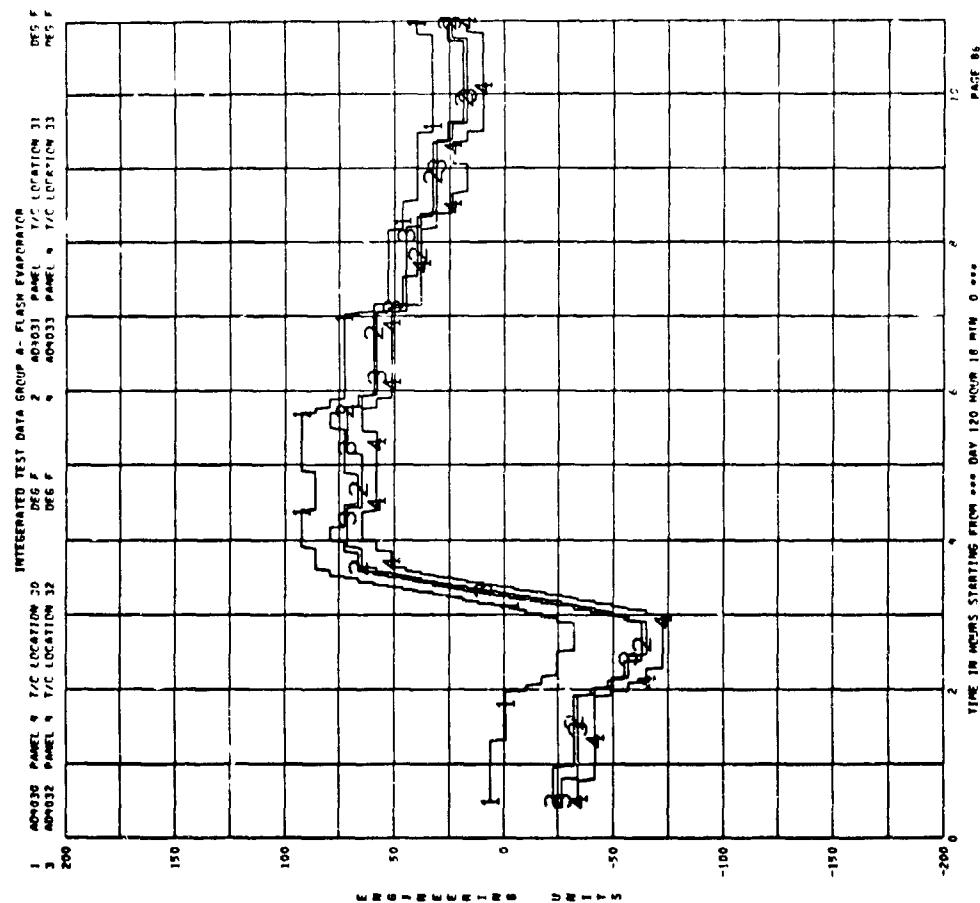
A-83



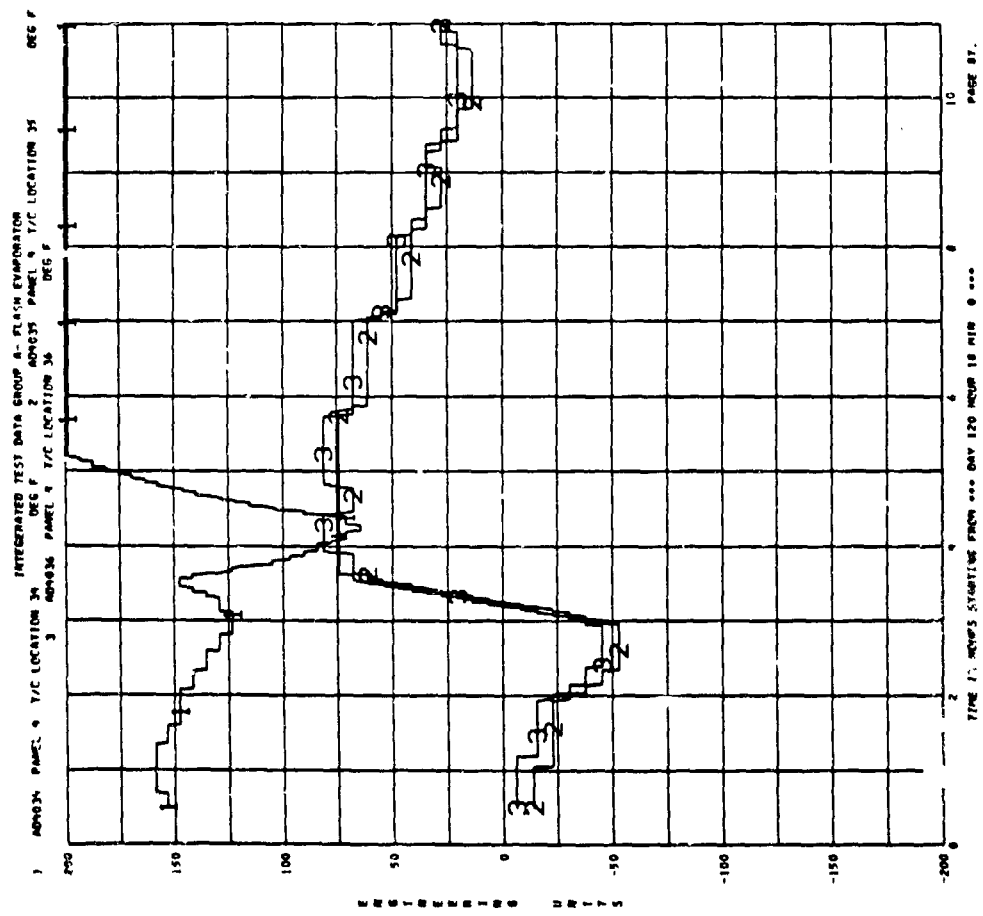
A-84



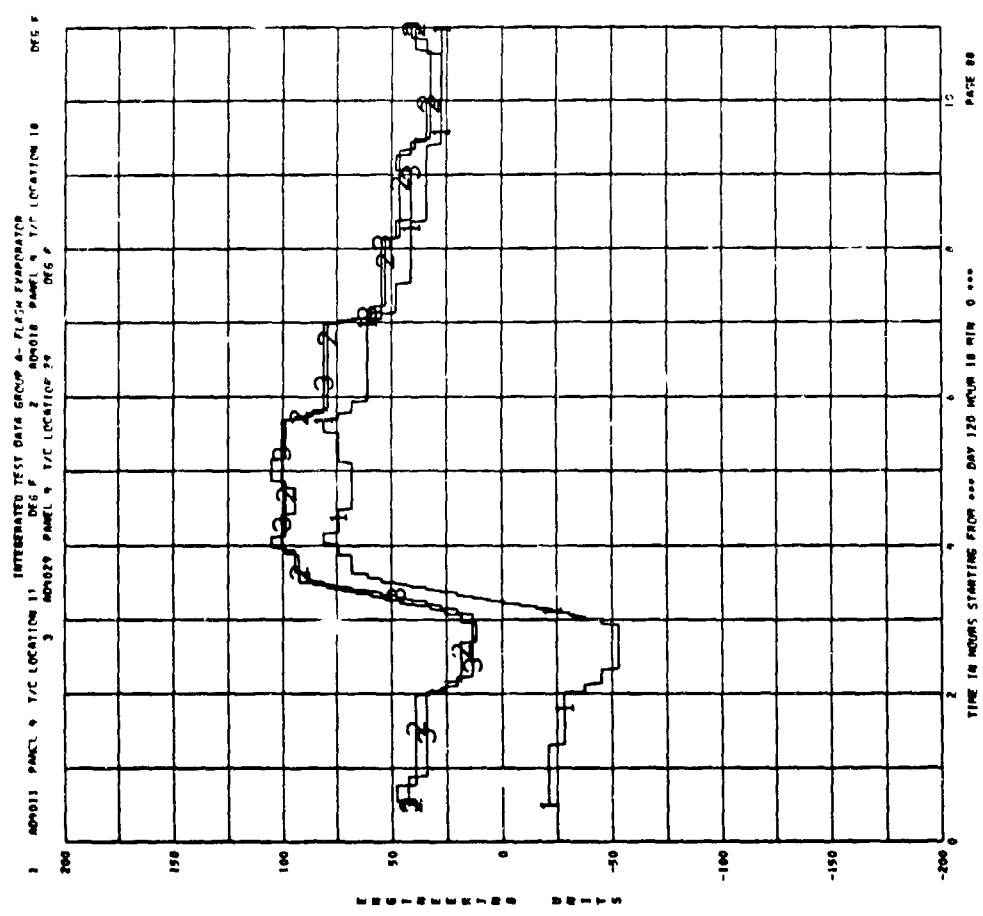
A-85



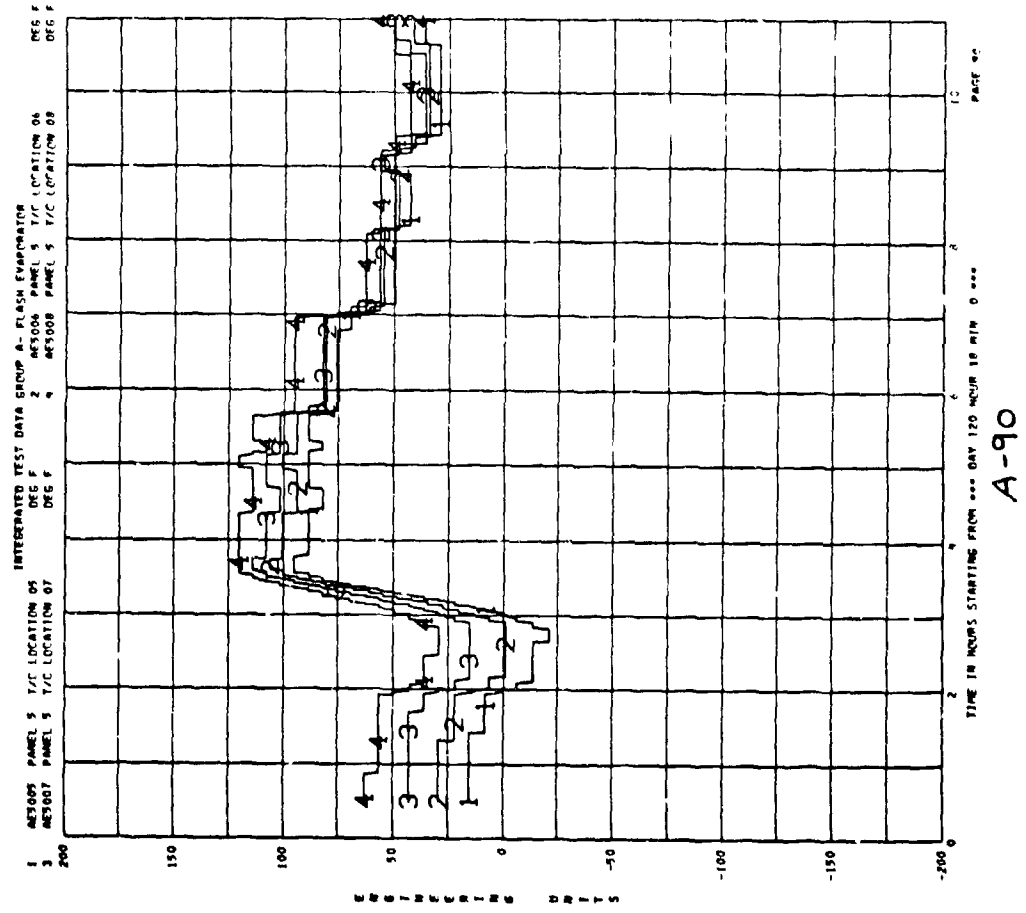
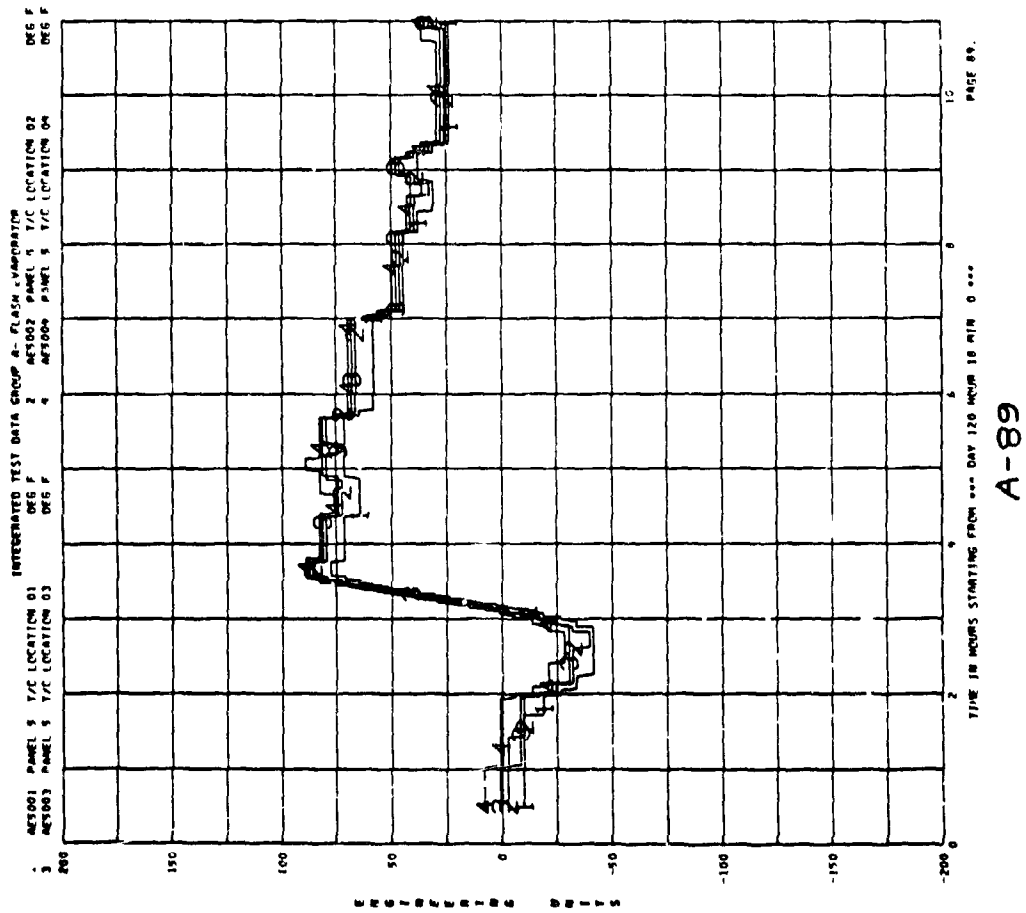
A-86

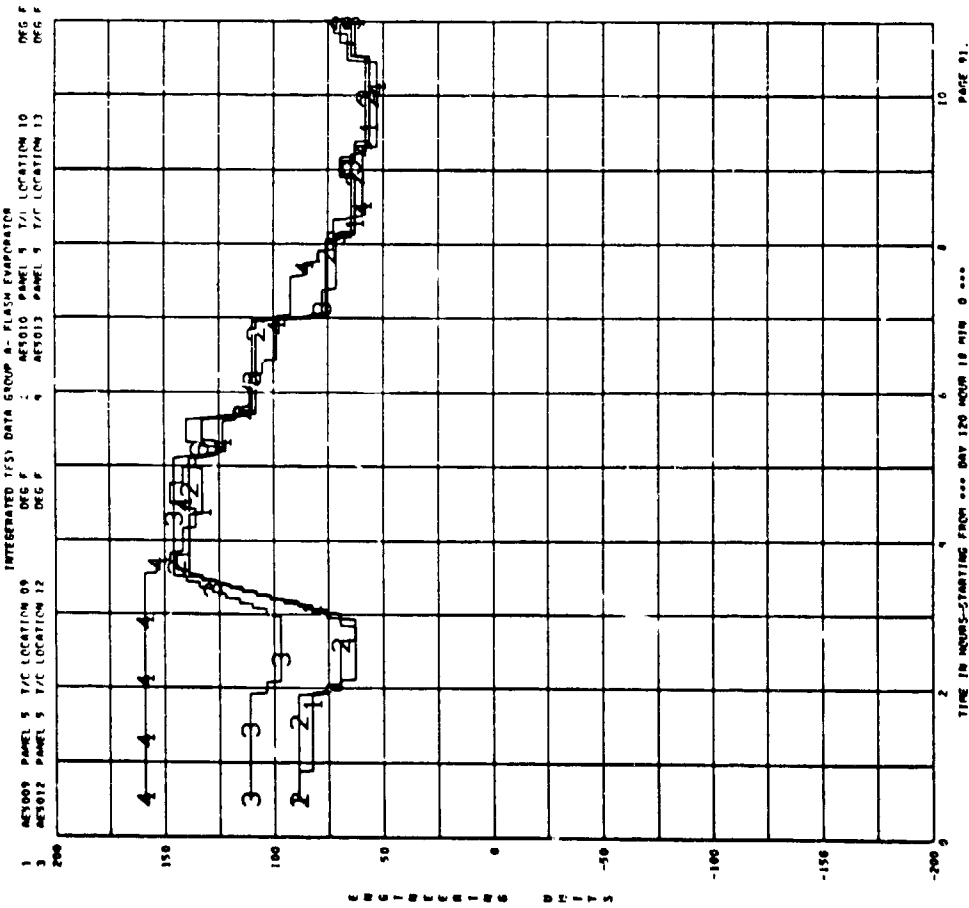


A-87

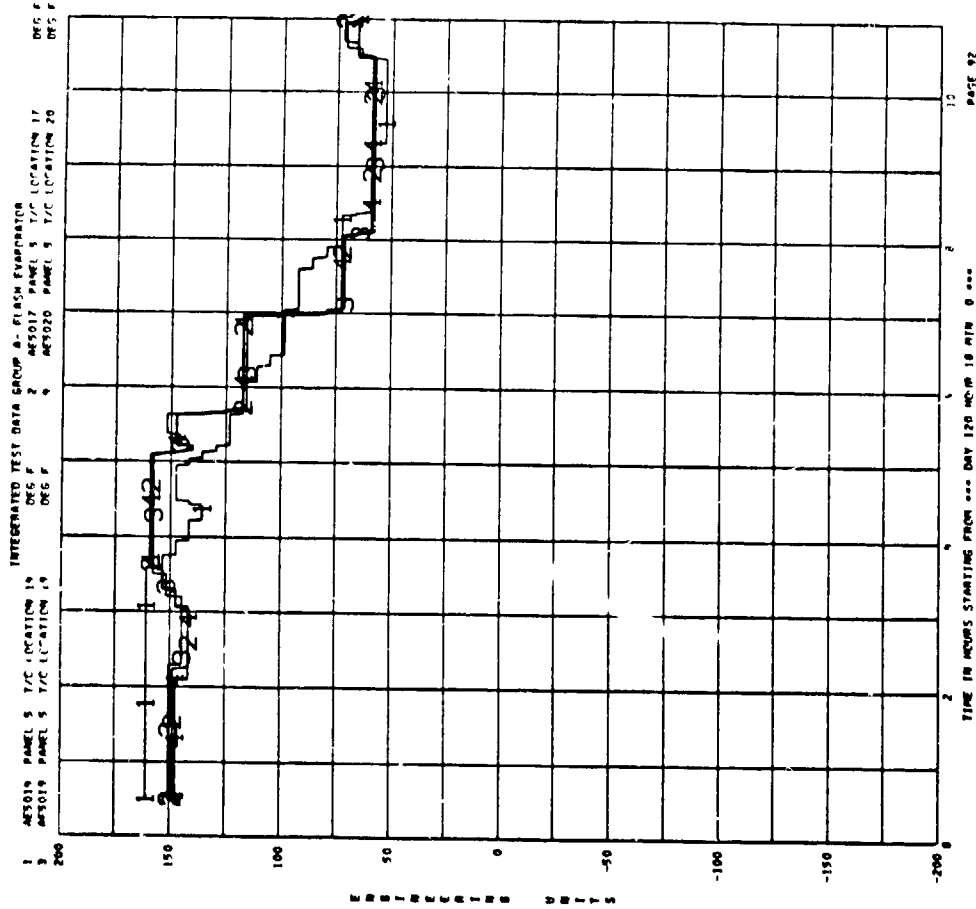


A-88

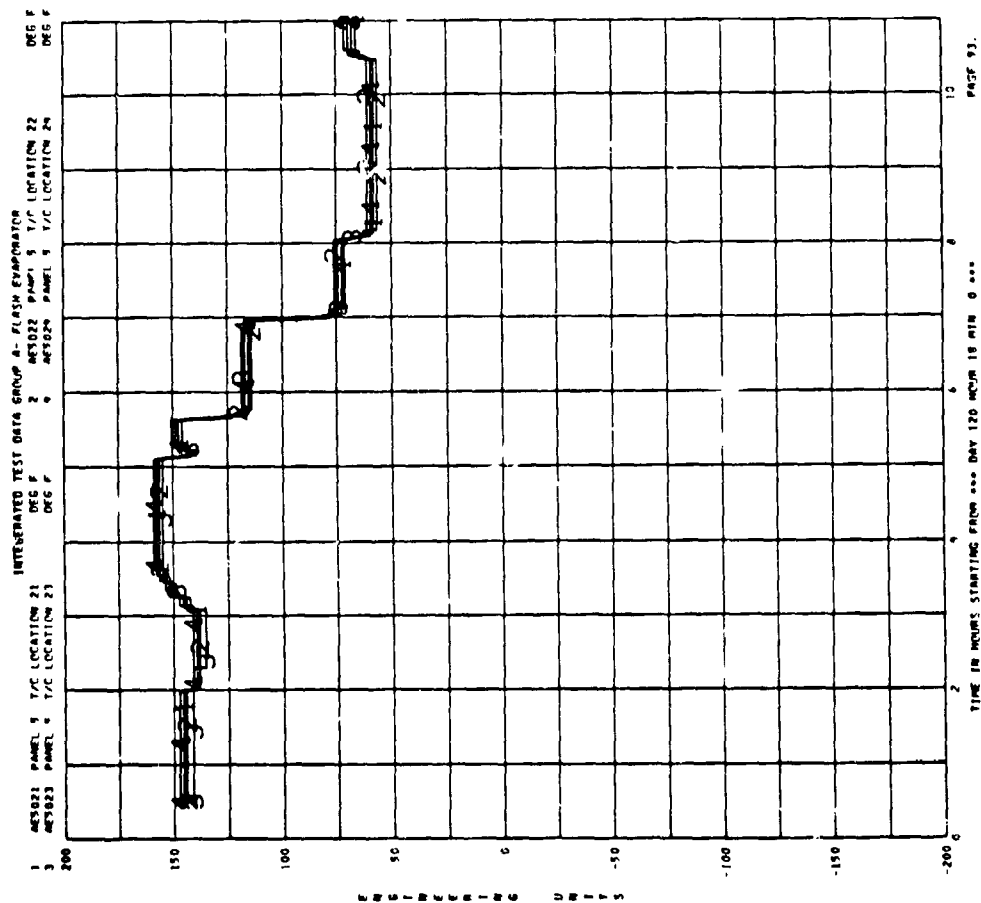




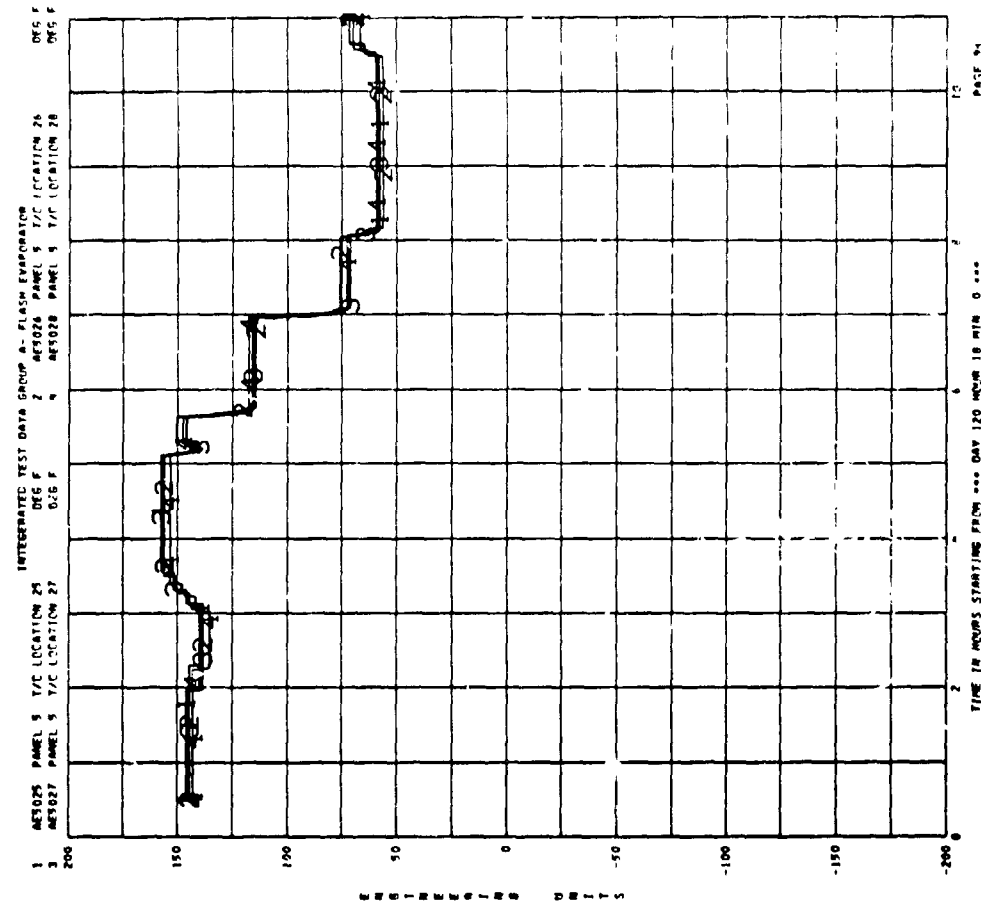
A-91



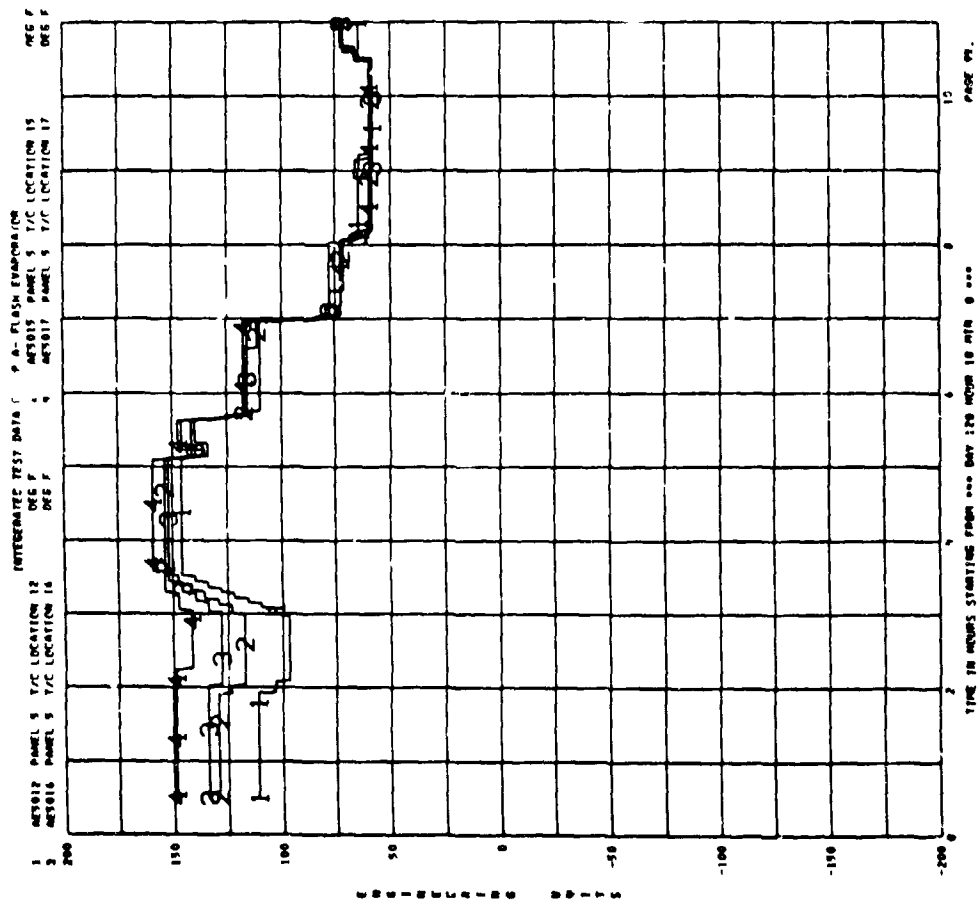
A-92



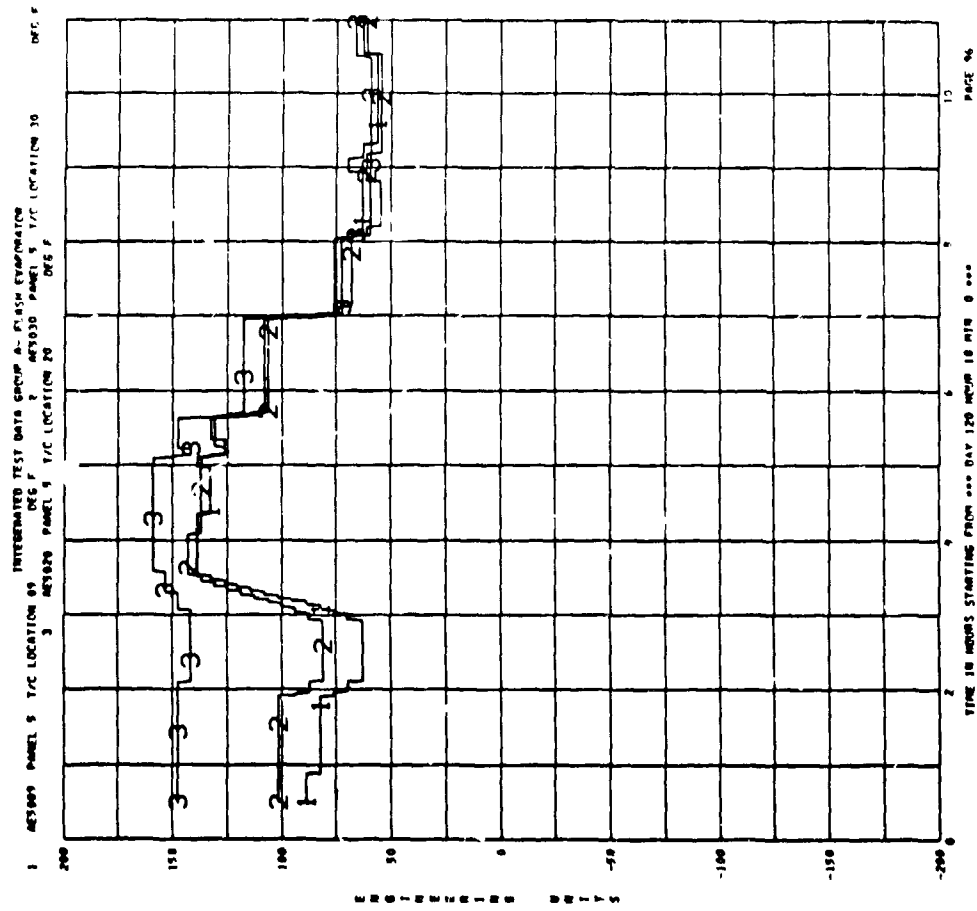
A-93



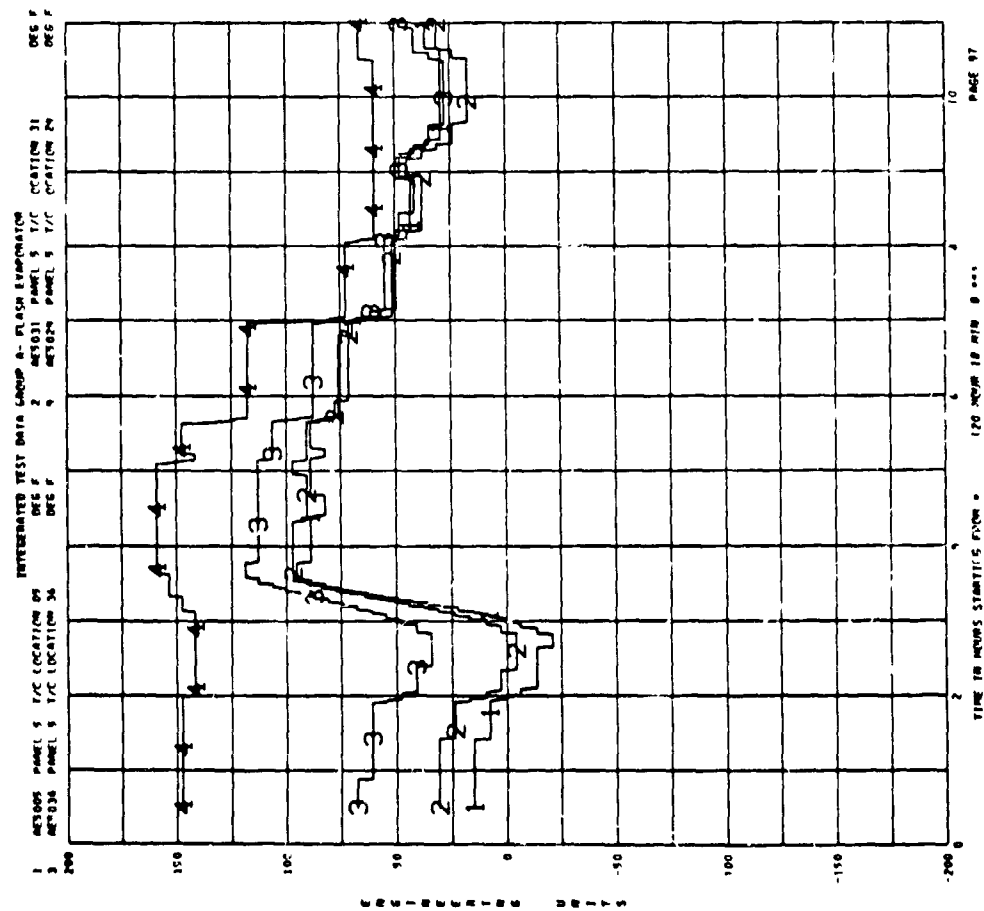
A-94



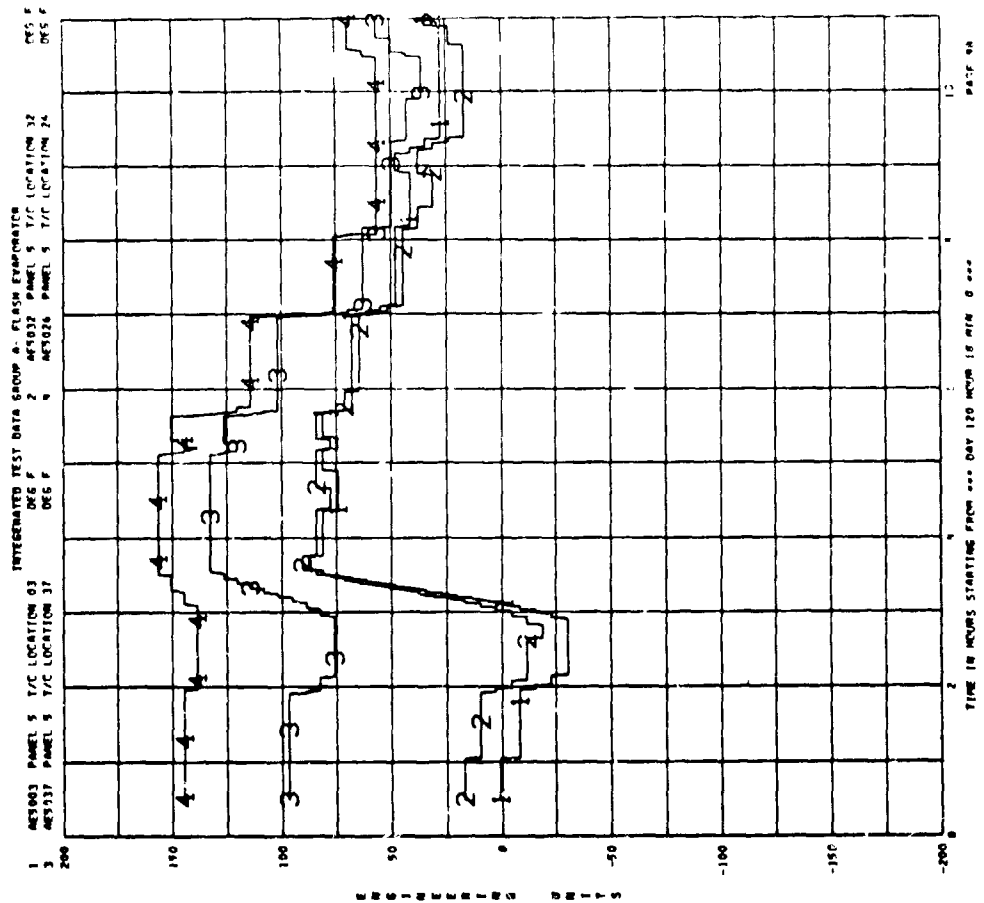
A-95

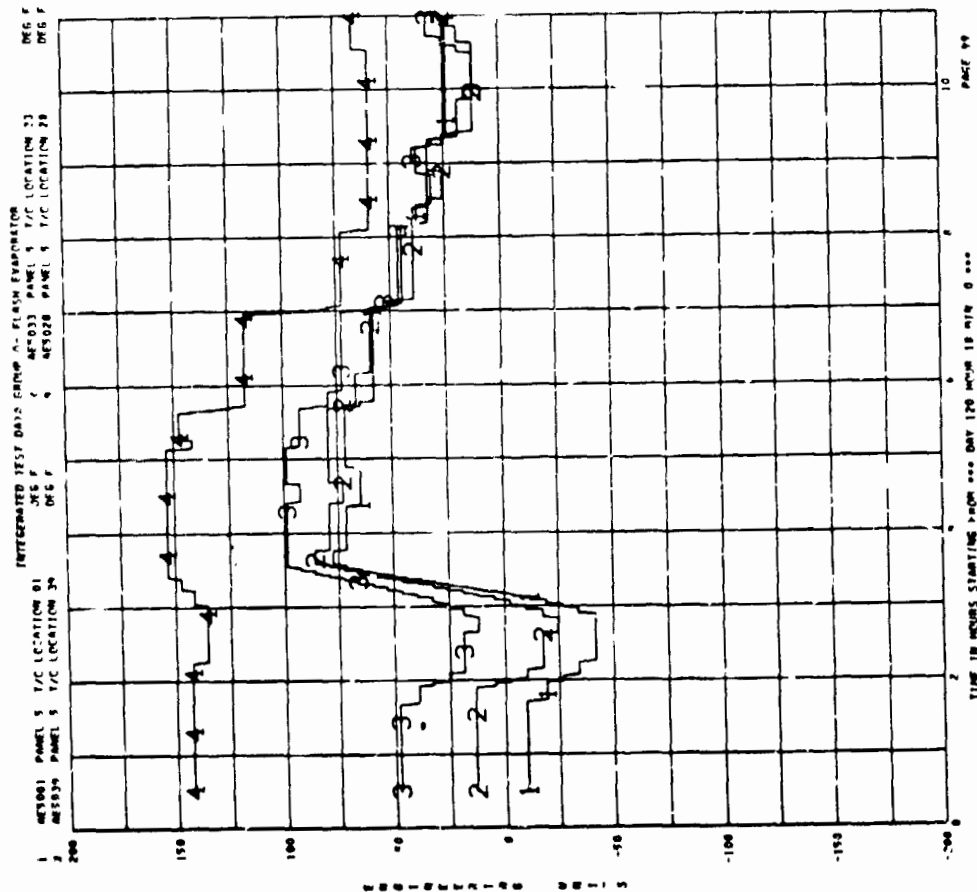


A-96

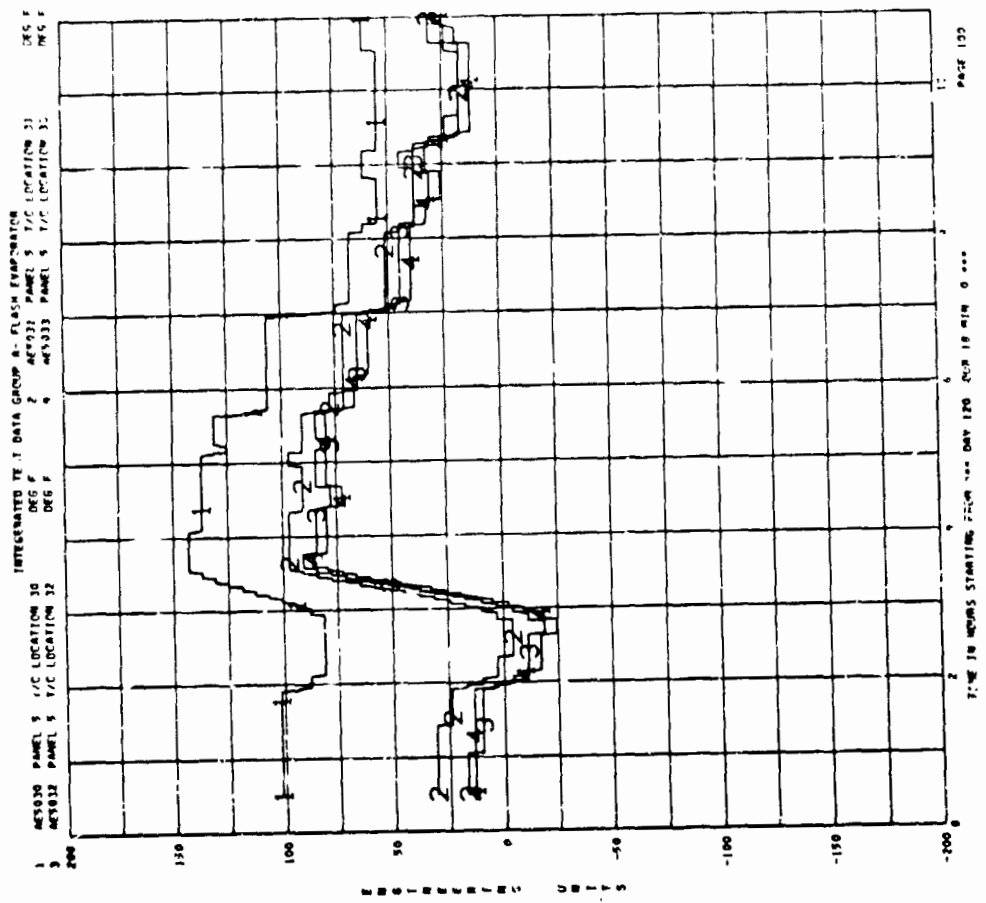


7

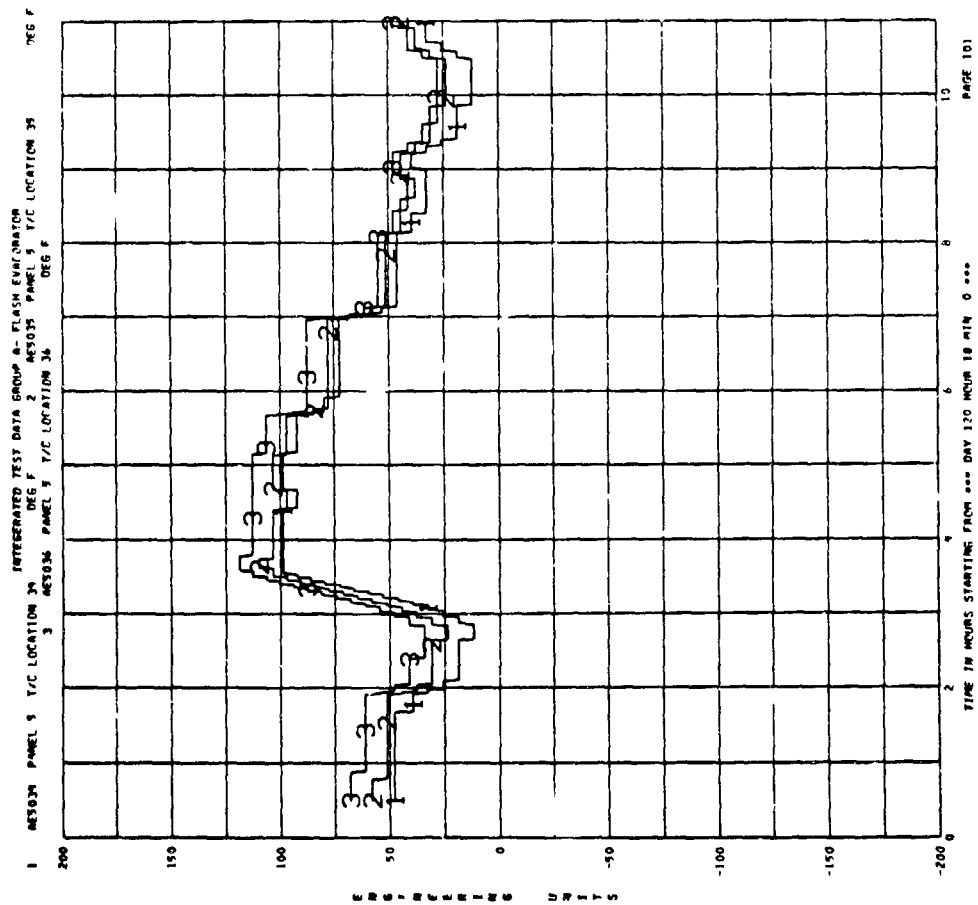




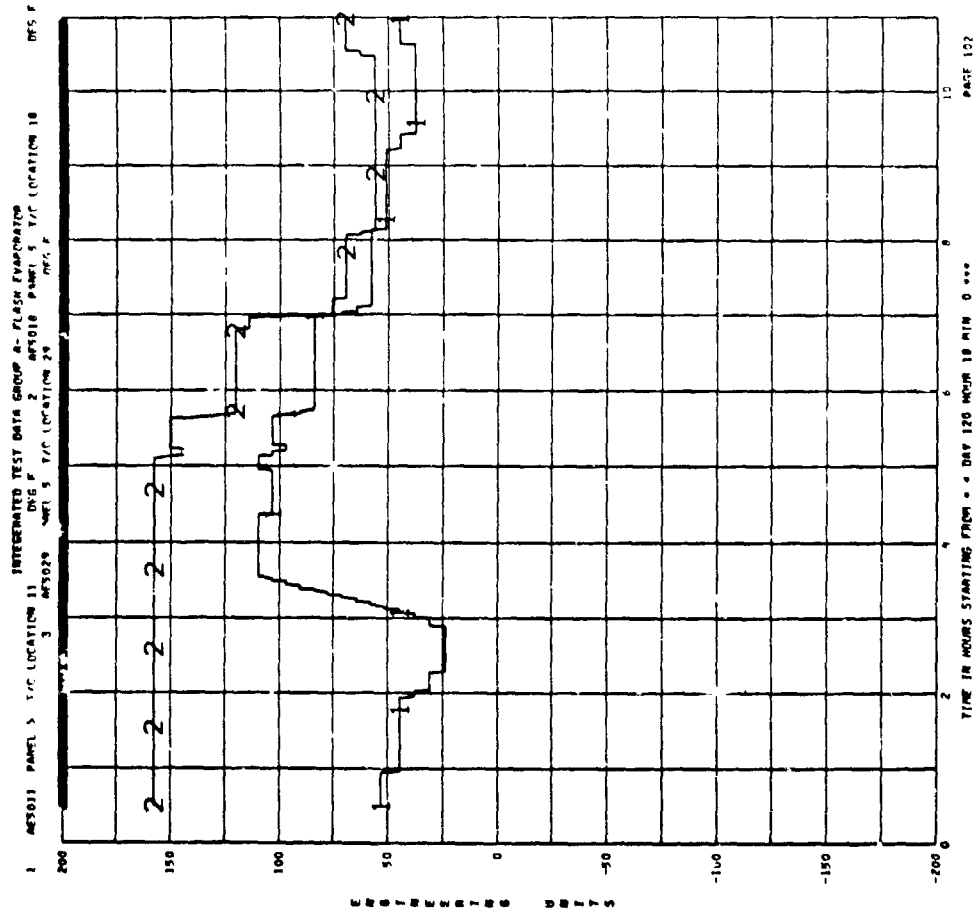
A-9;



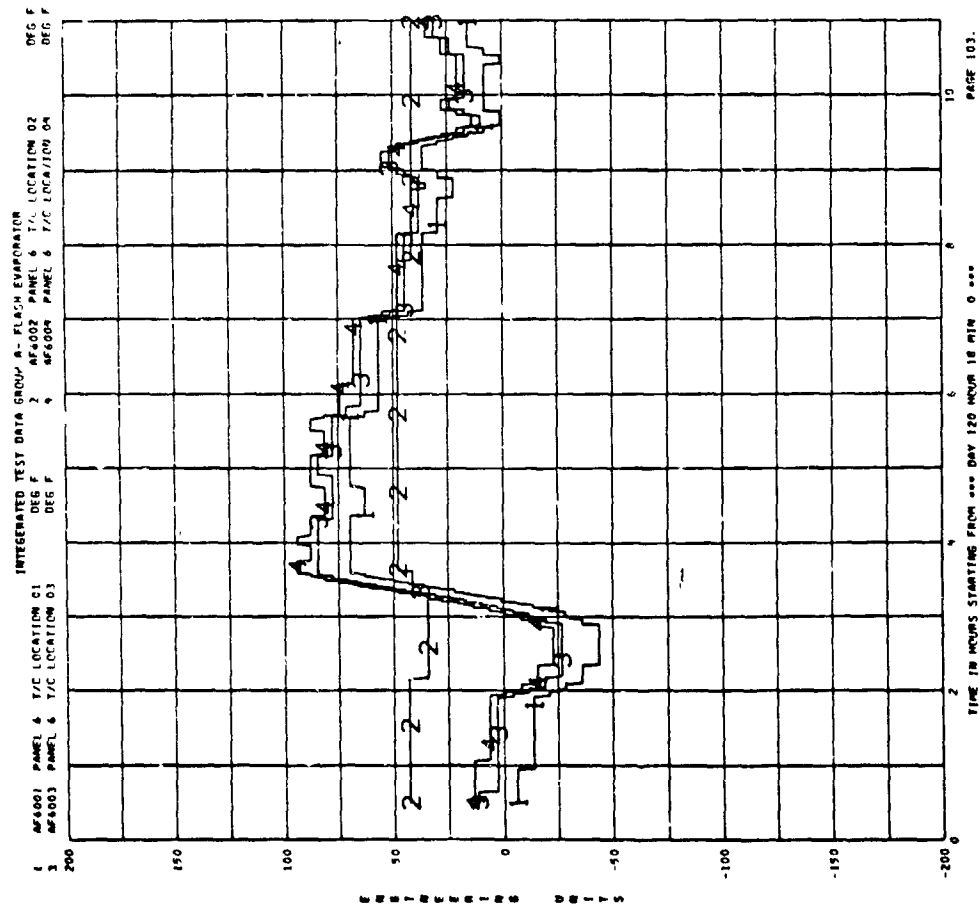
A-100



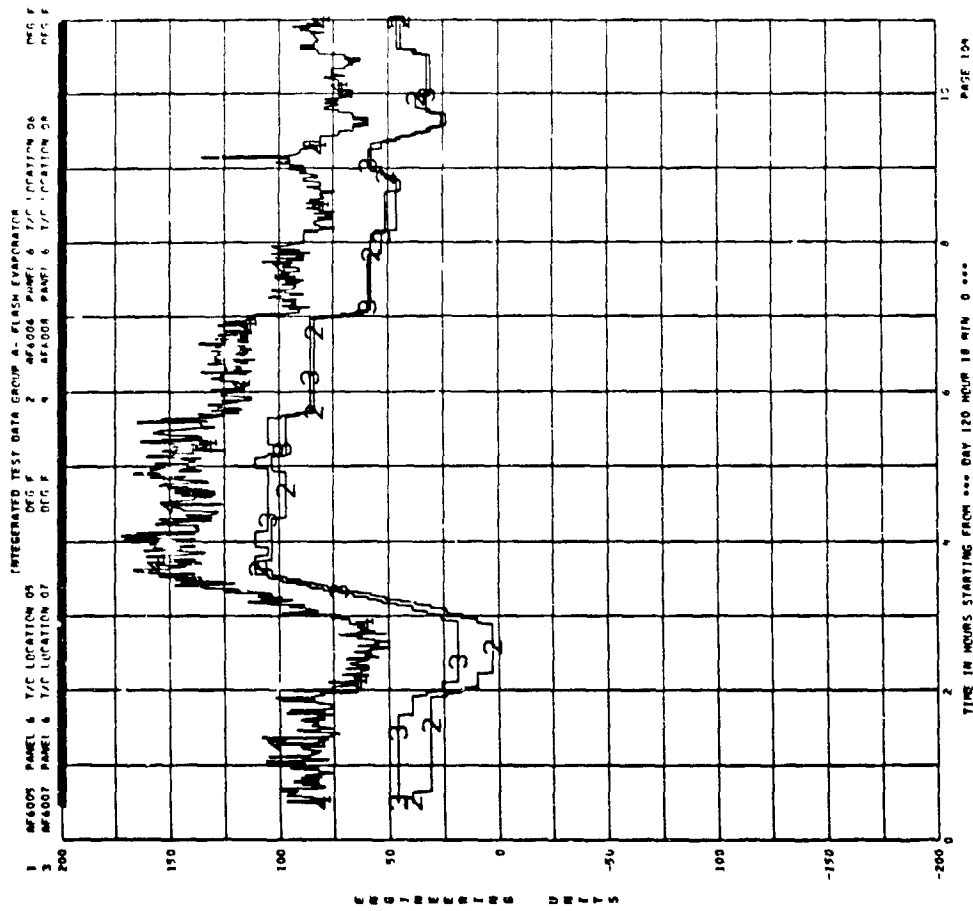
A-101



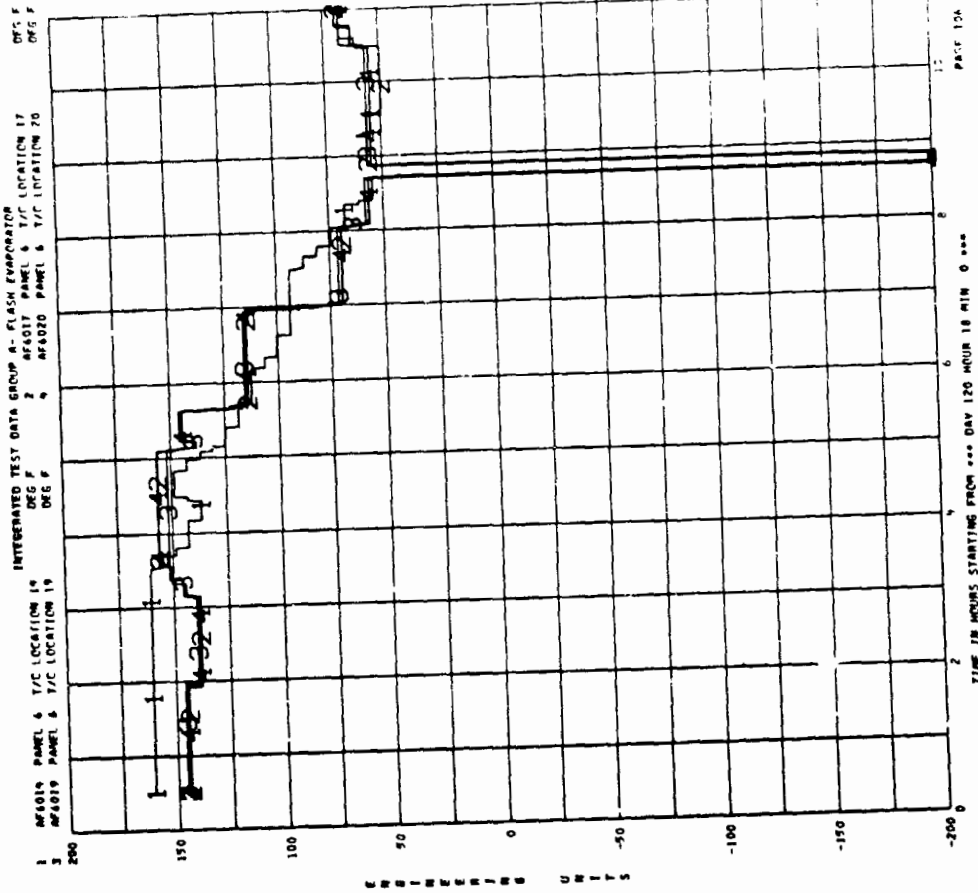
A-102



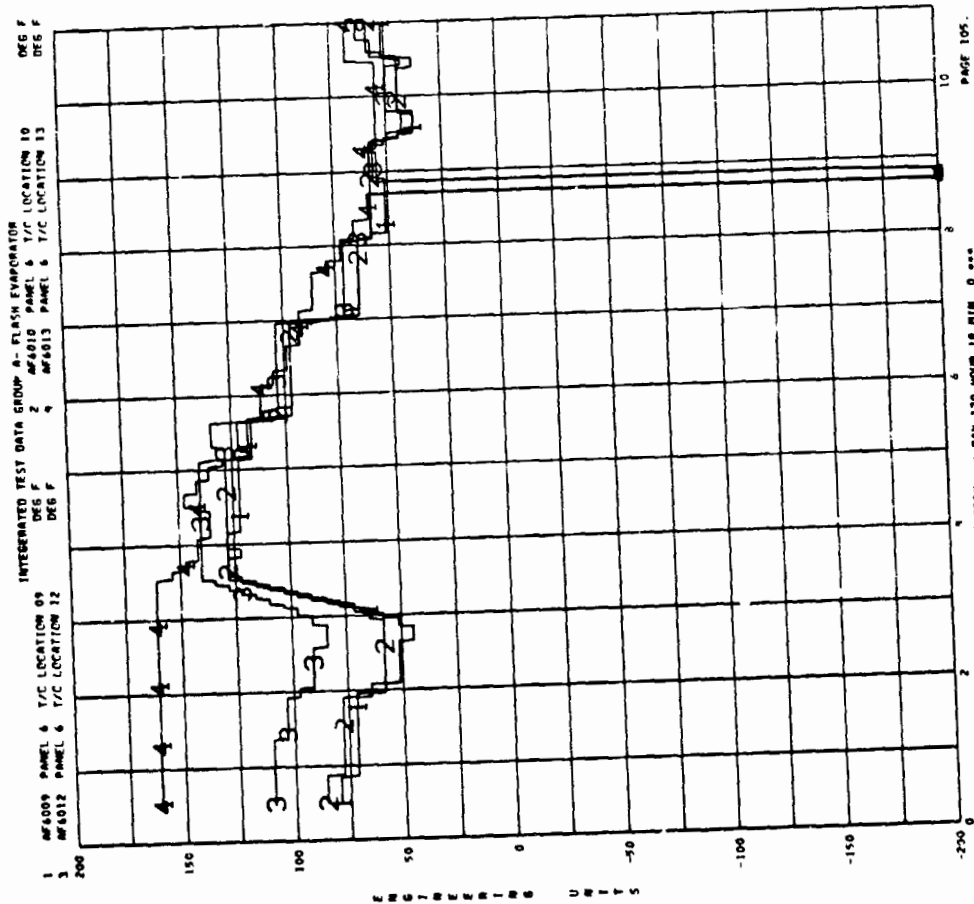
A-103



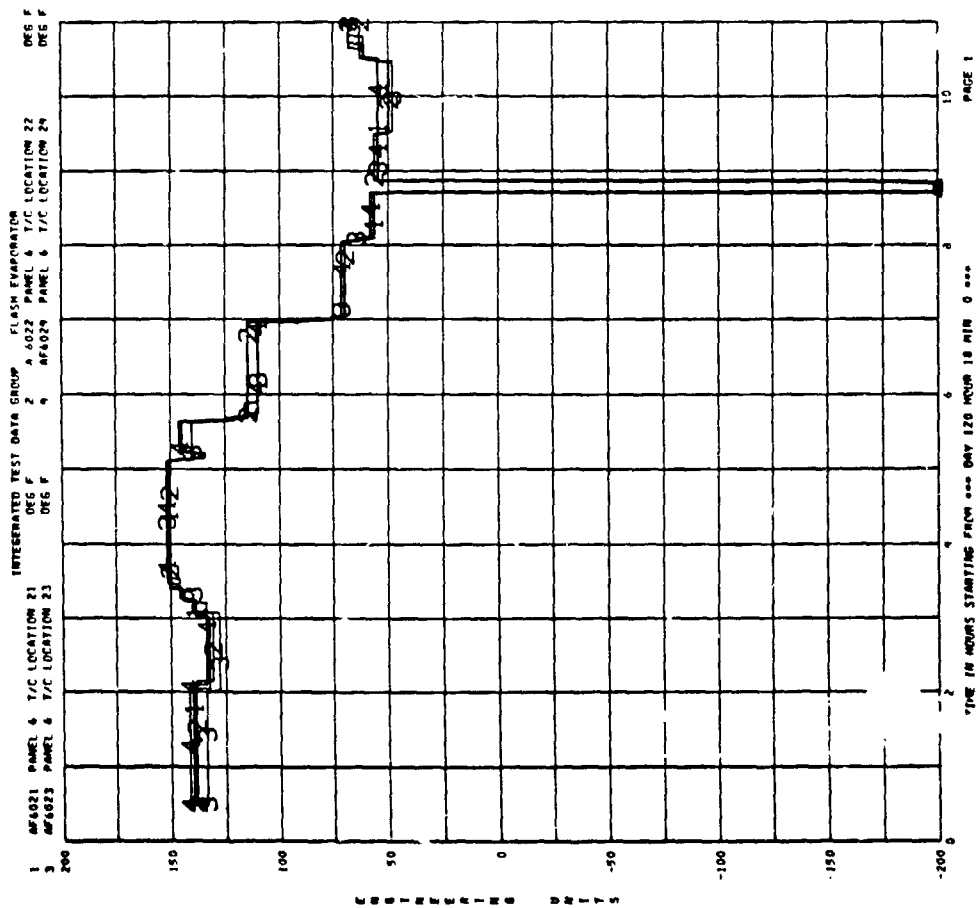
A-104



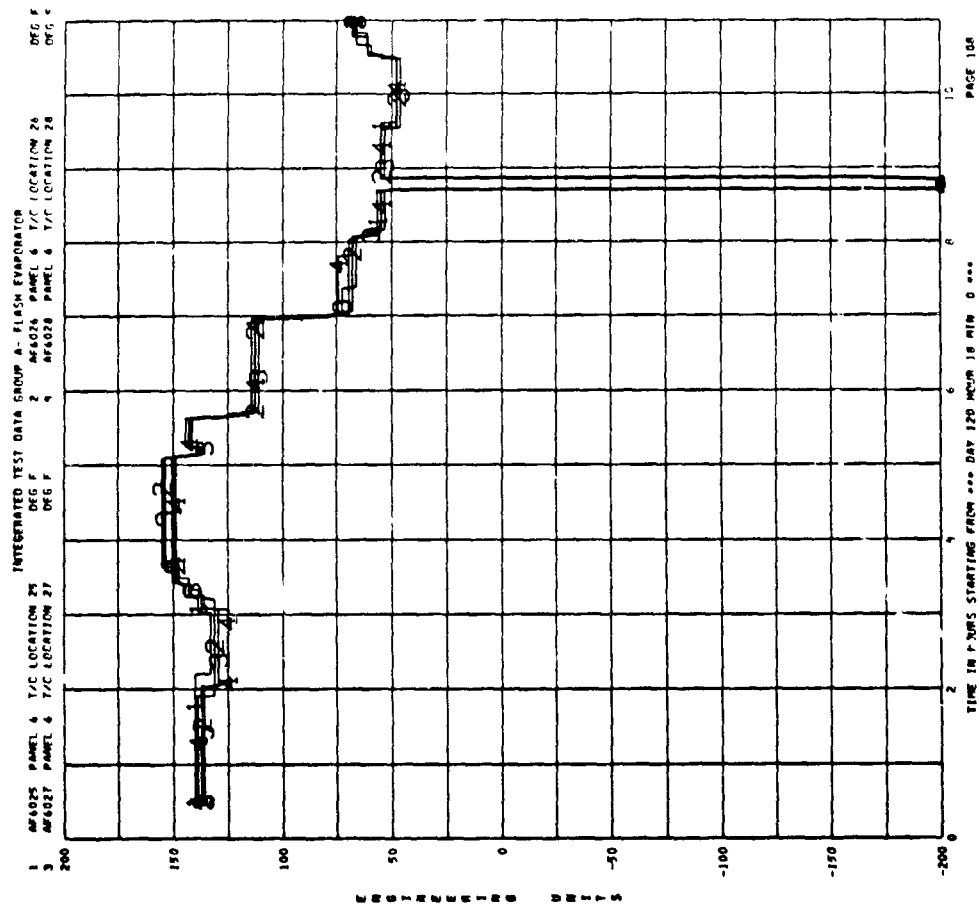
A-106



A-105



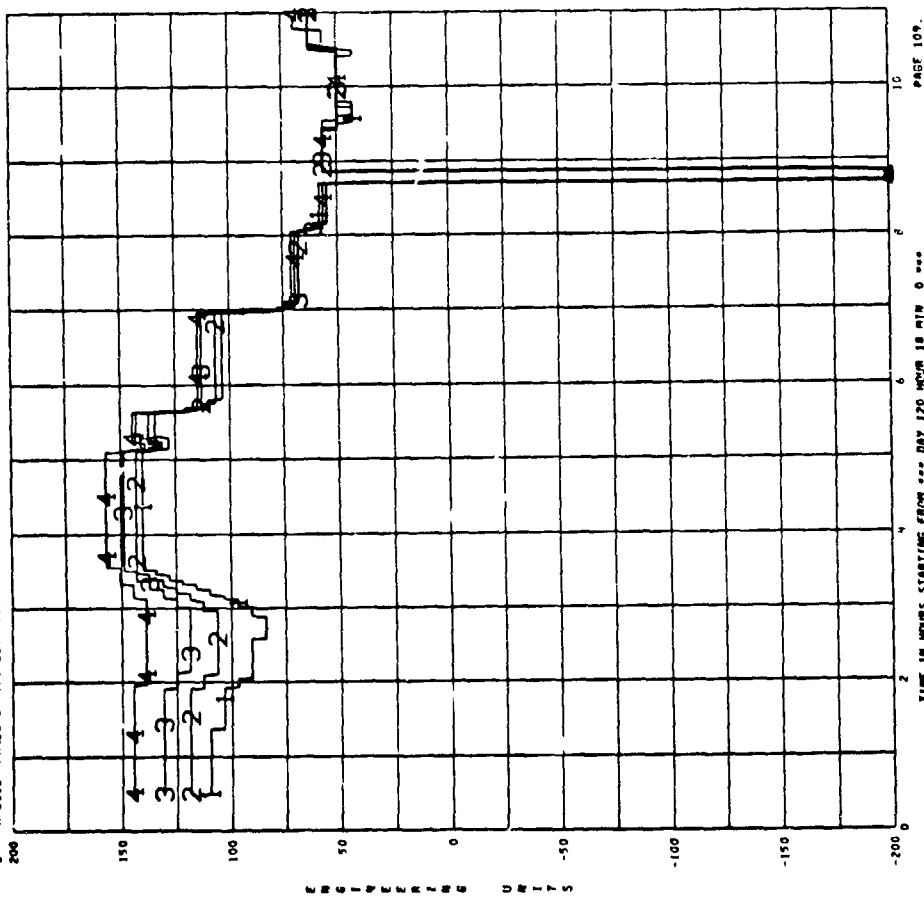
A-107



A-108

INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION

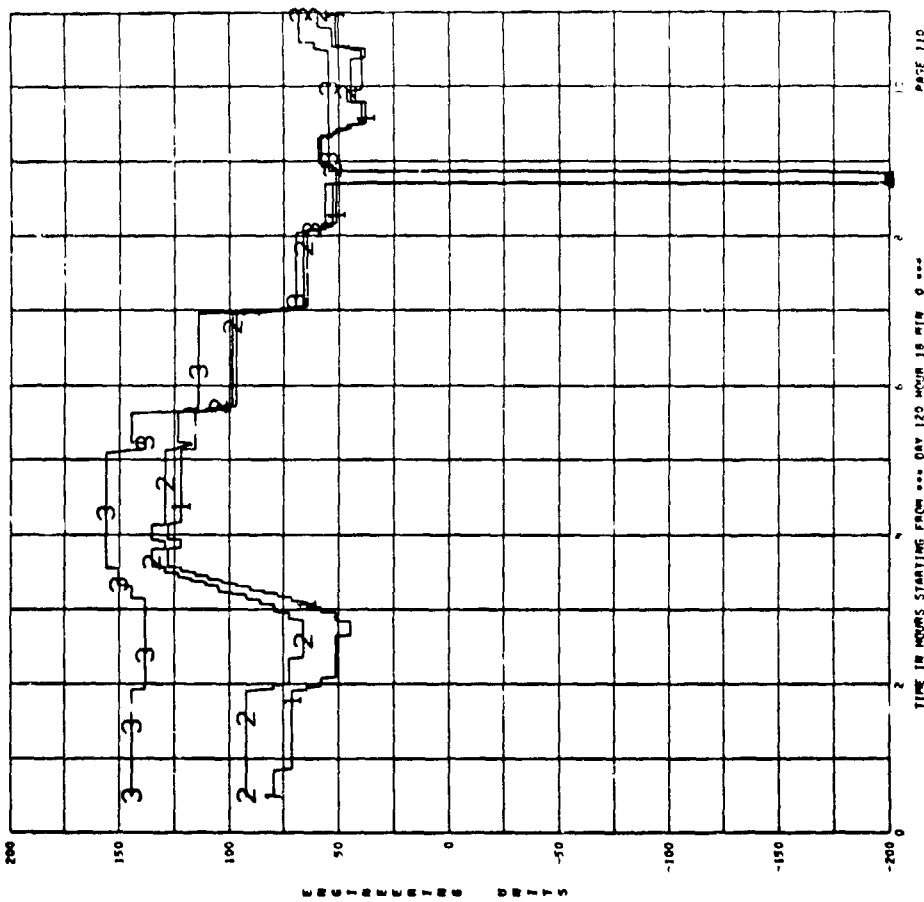
1 AF6012 PANEL 6 T/C LOCATION 12 DEG F 2 AF6015 PANEL 6 T/C LOCATION 15 DEG F
3 AF6016 PANEL 6 T/C LOCATION 16 DEG F 4 AF6017 PANEL 6 T/C LOCATION 17 DEG F



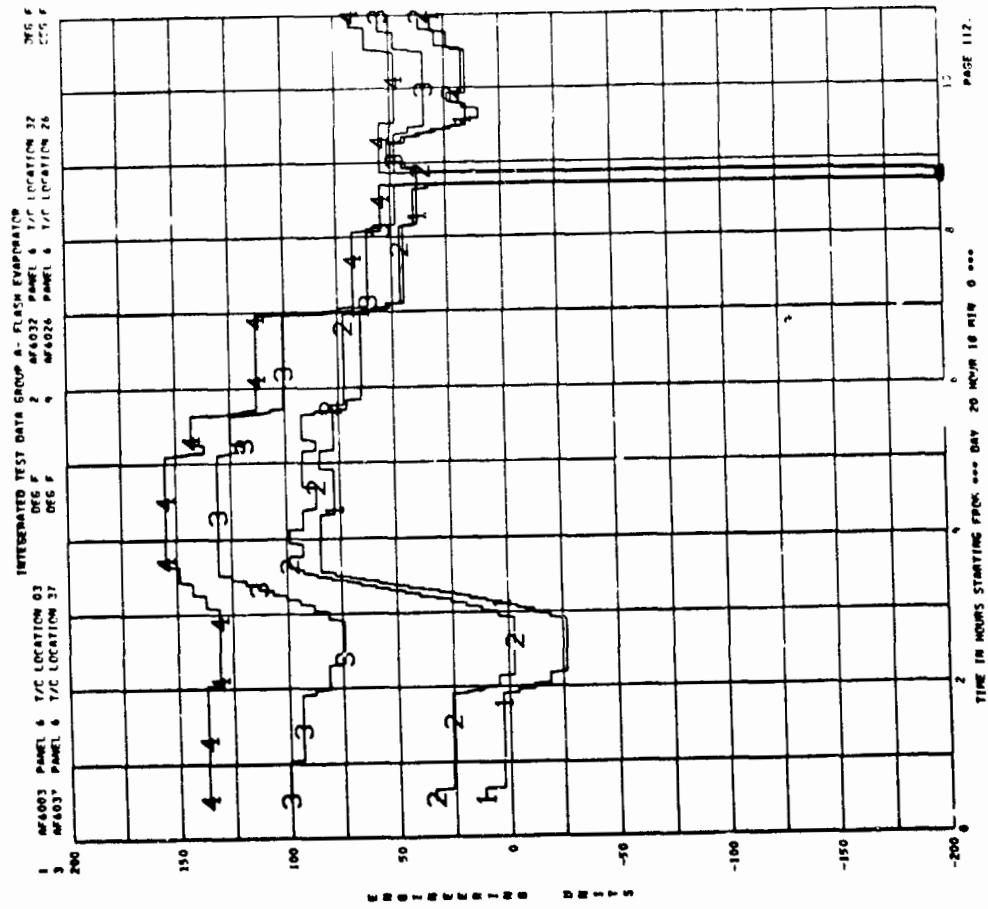
A-109

INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION

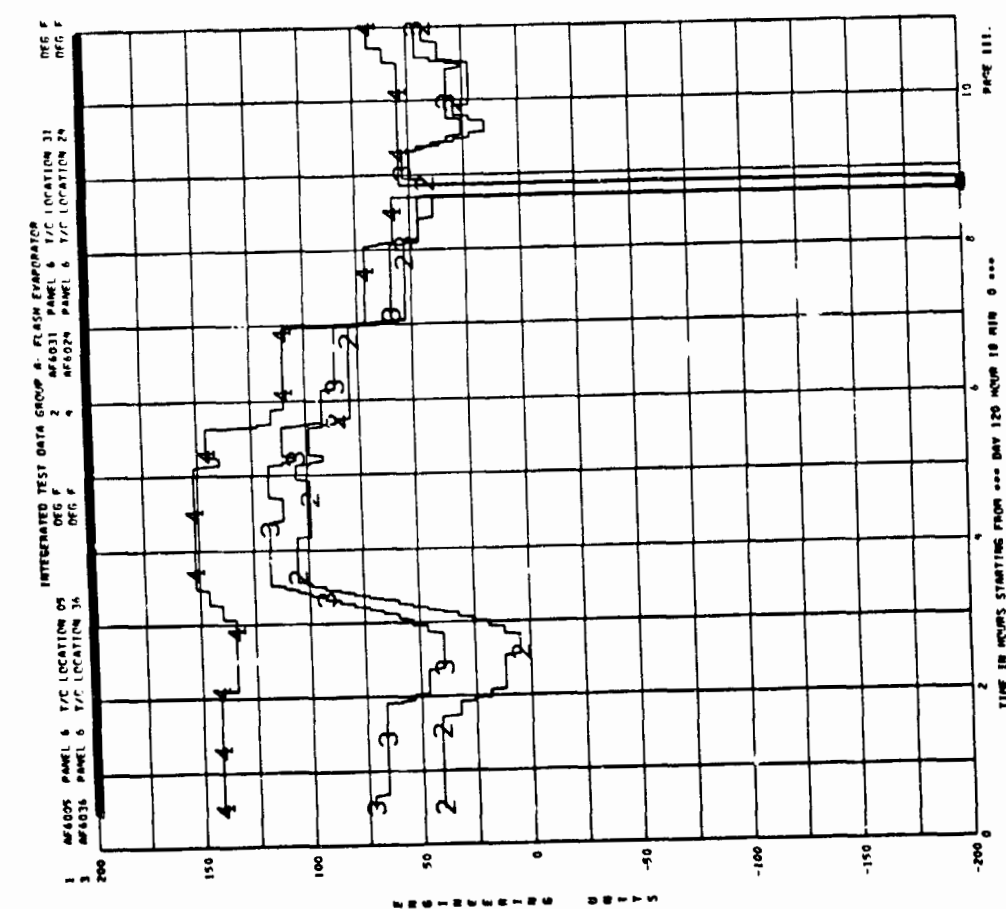
1 AF6009 PANEL 6 T/C LOCATION 09 DEG F 2 AF6010 PANEL 6 T/C LOCATION 10 DEG F
3 AF6020 PANEL 6 T/C LOCATION 20 DEG F



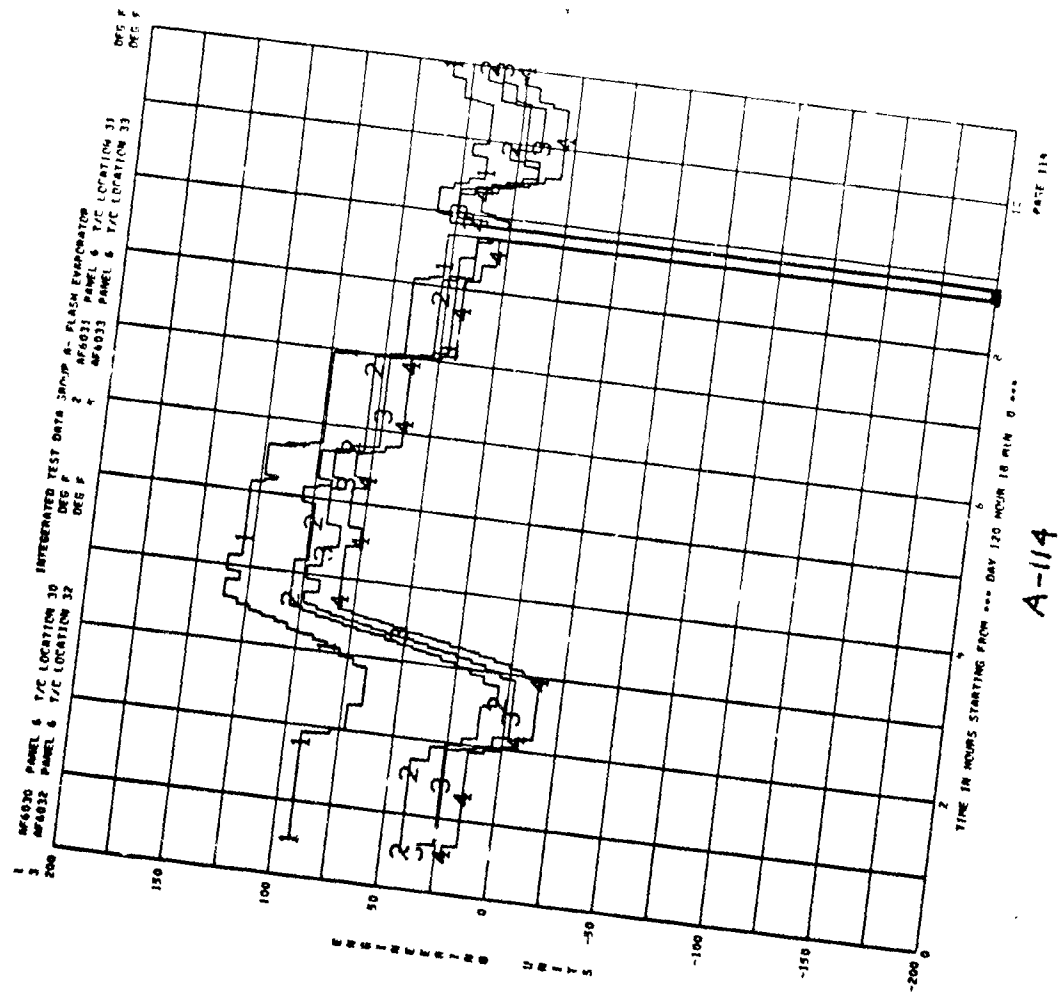
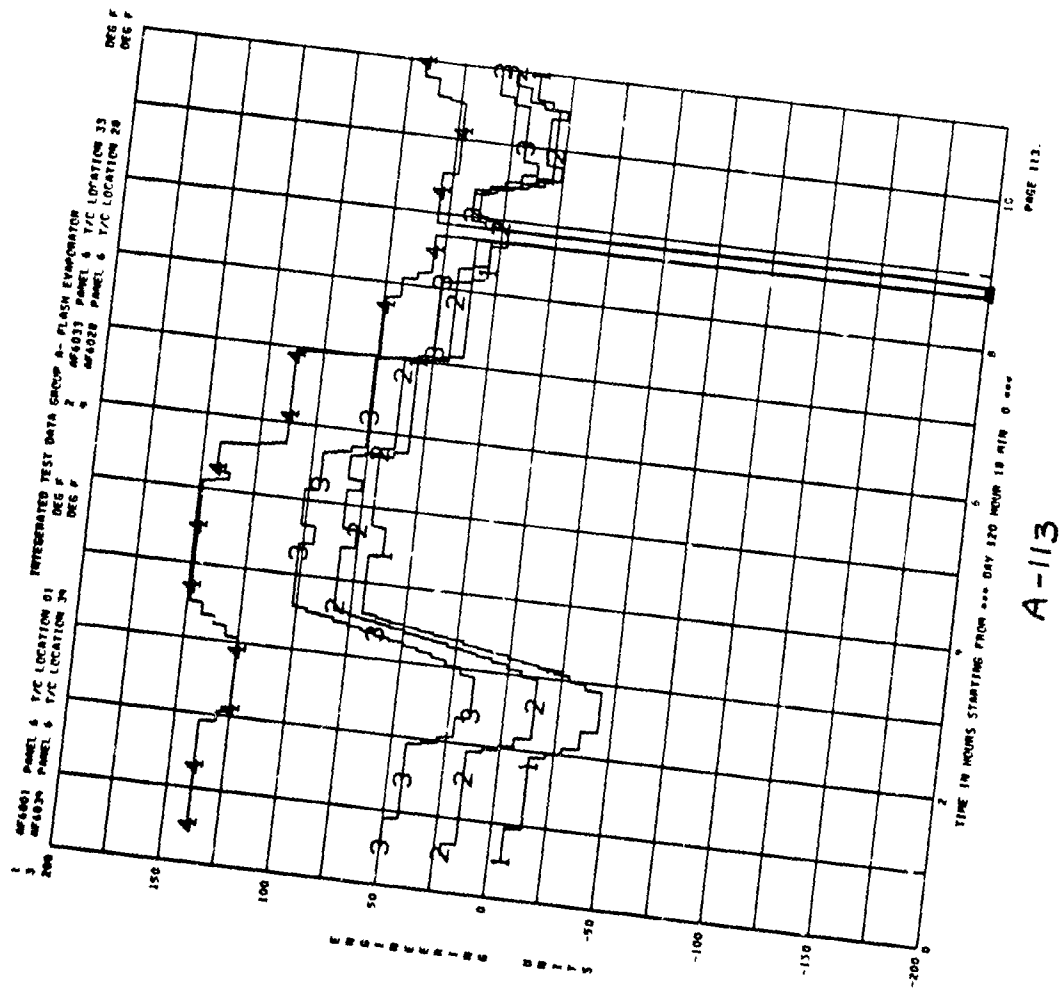
A-110

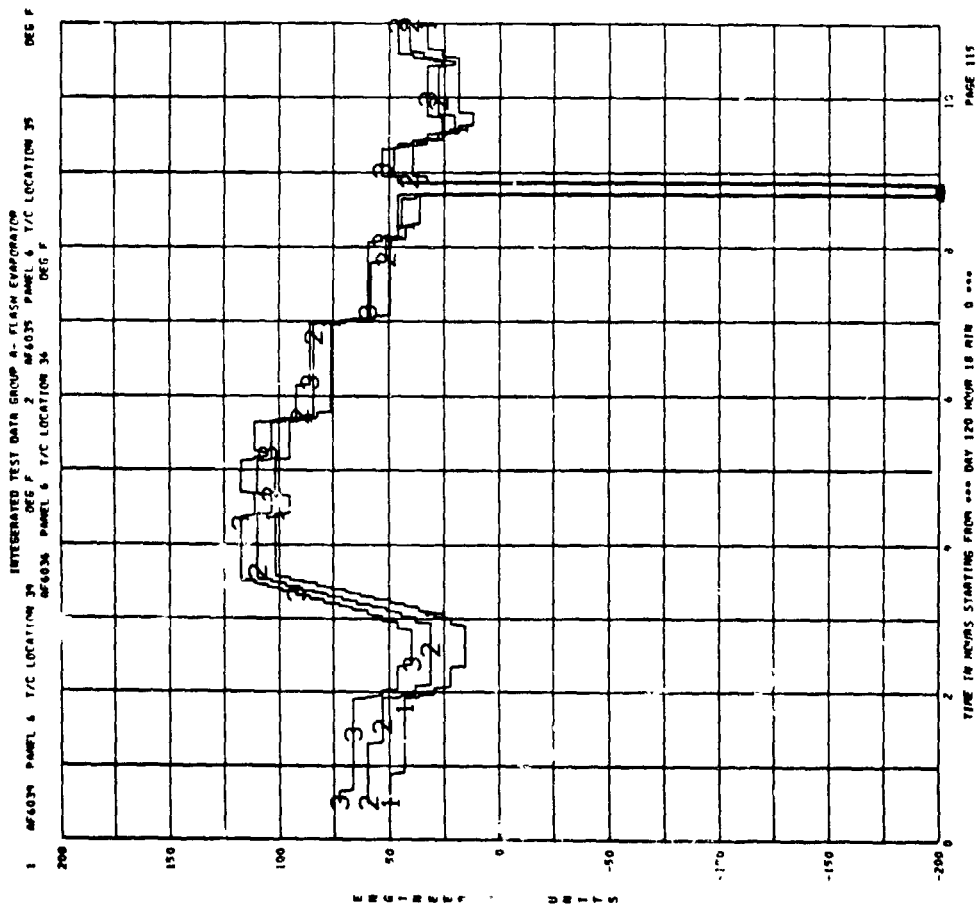


A-112

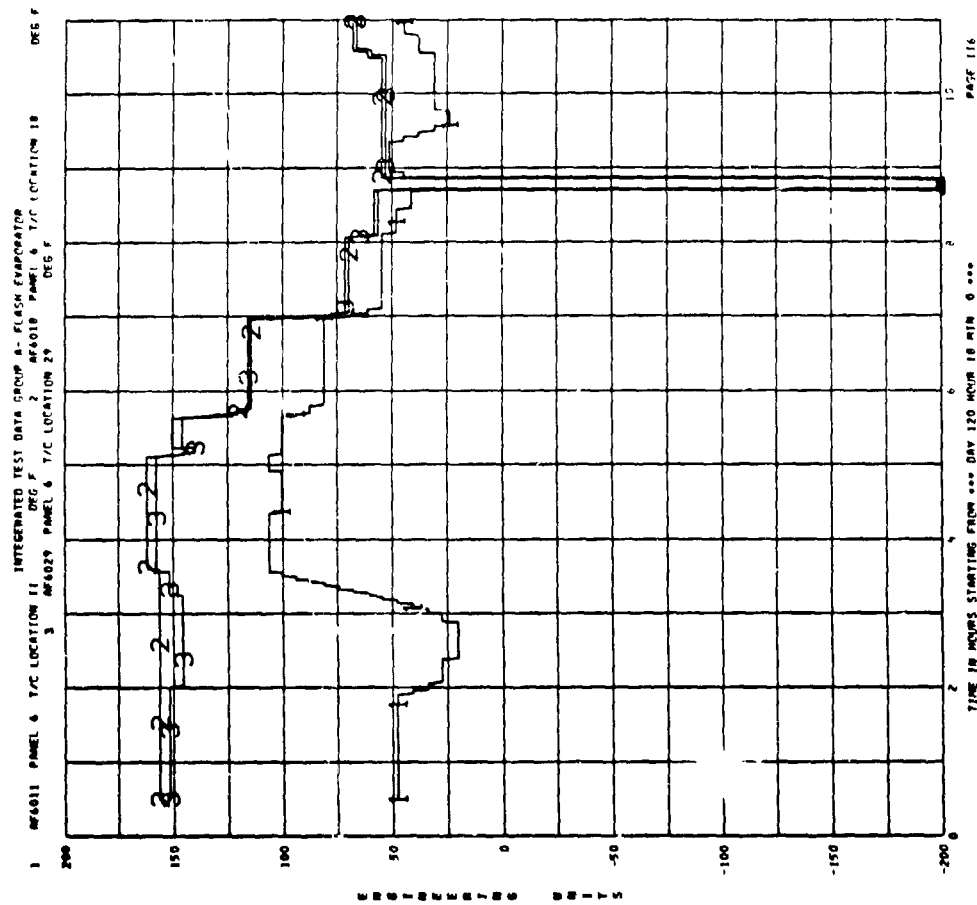


A-111

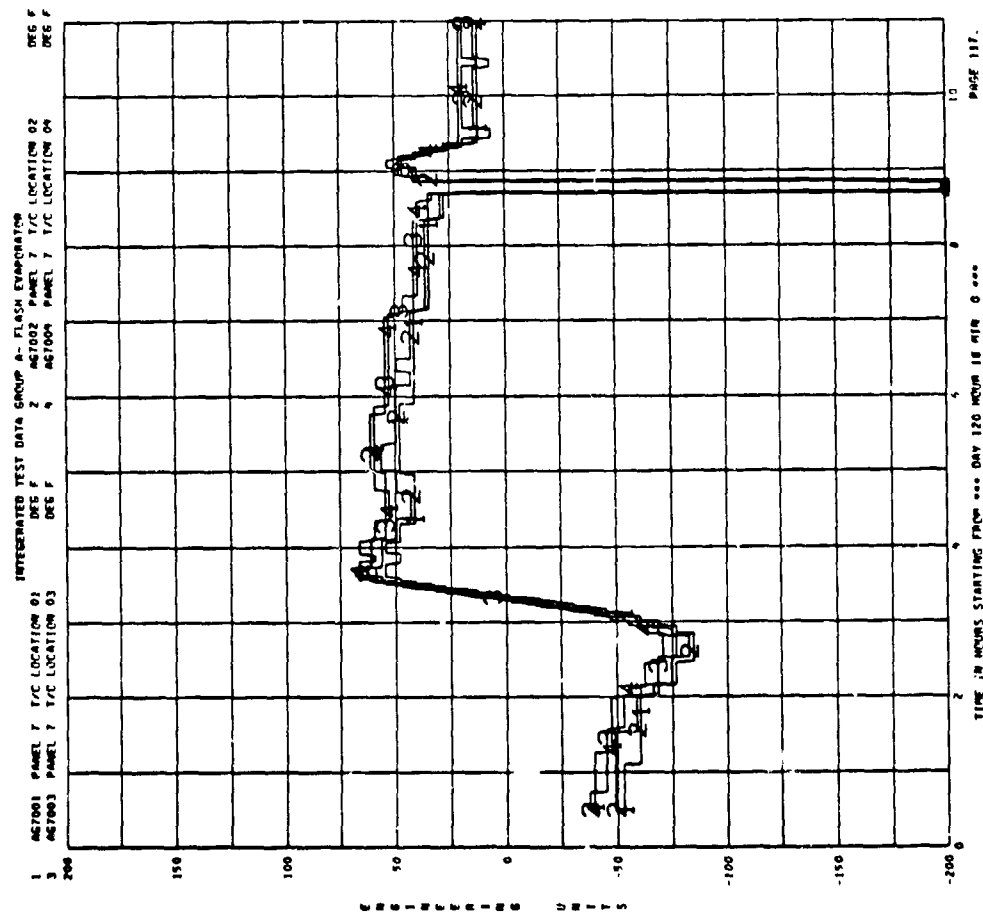




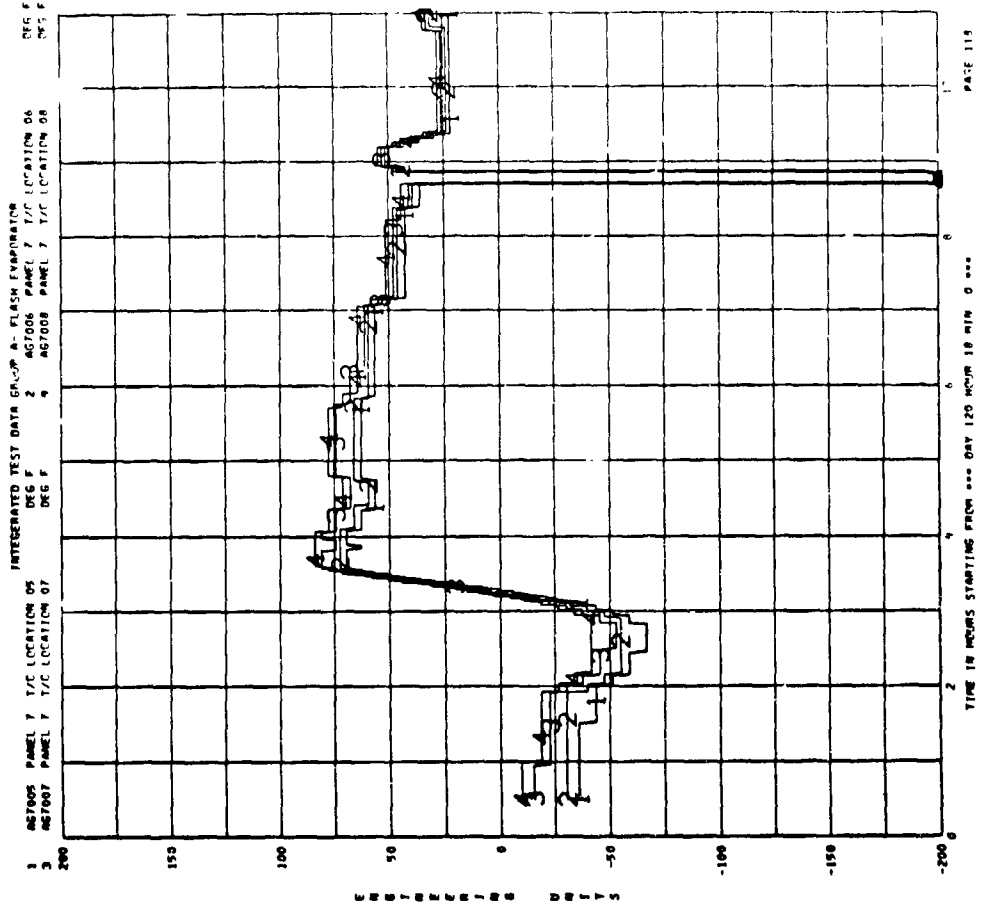
A-115



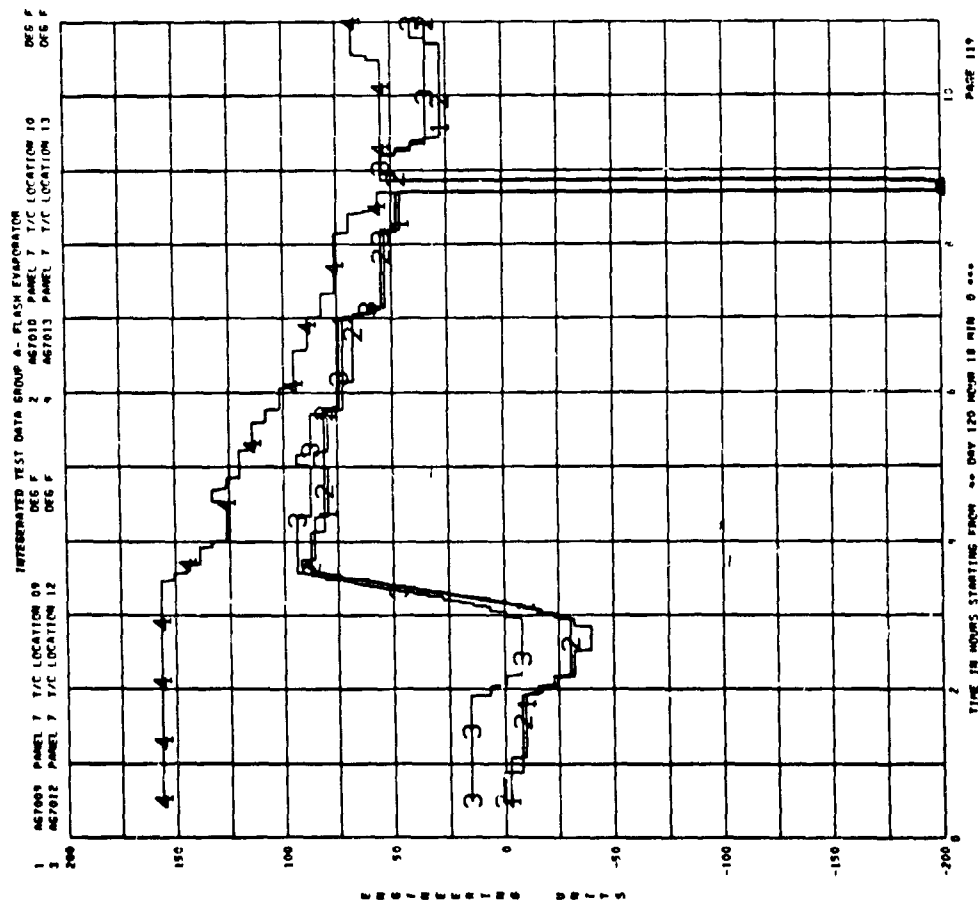
A-116



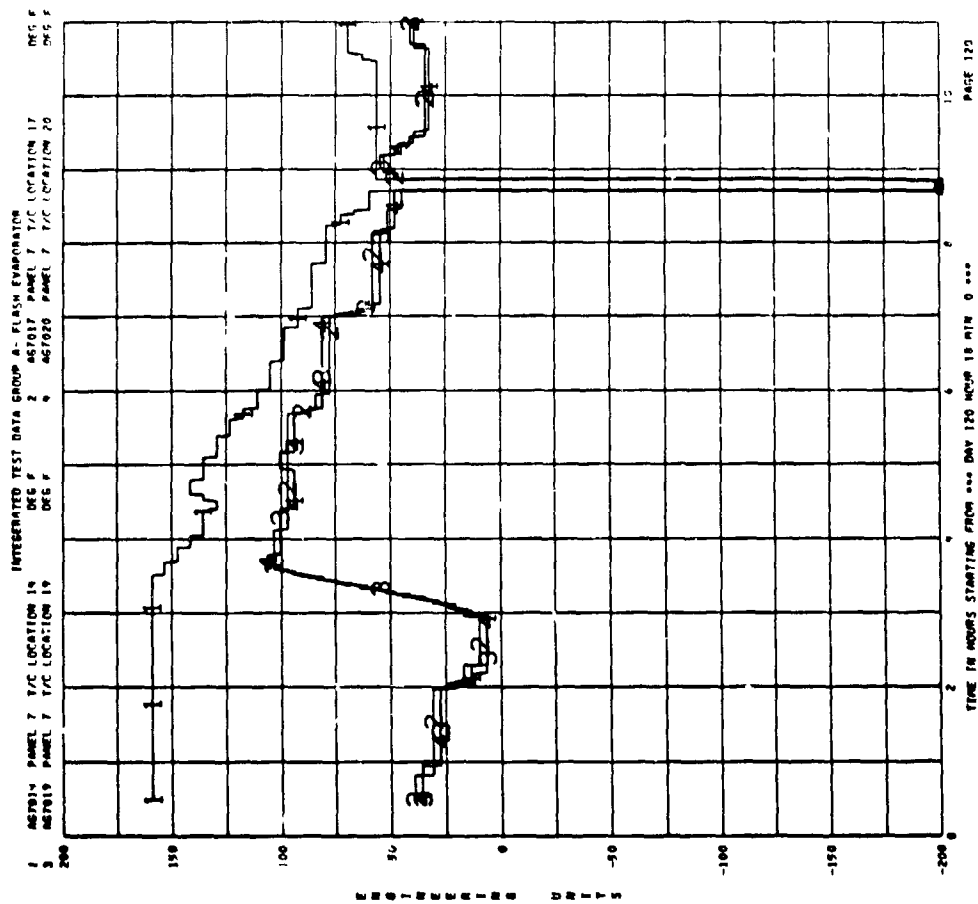
A-117



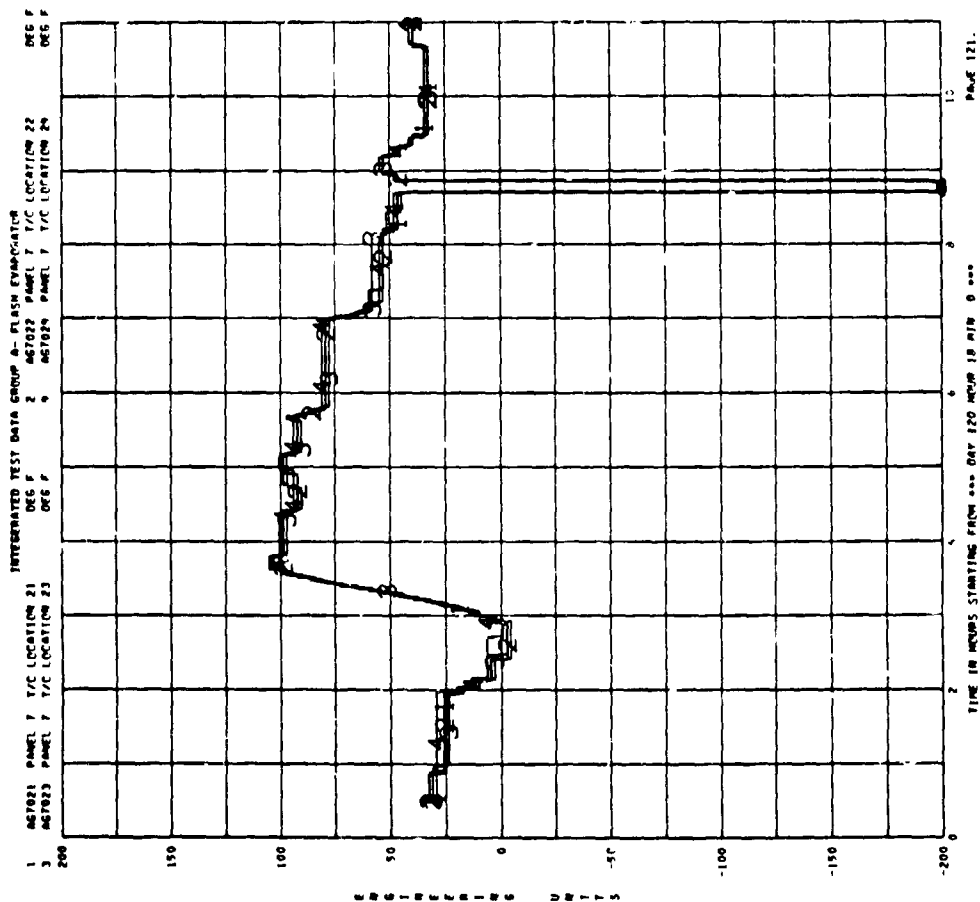
A-118



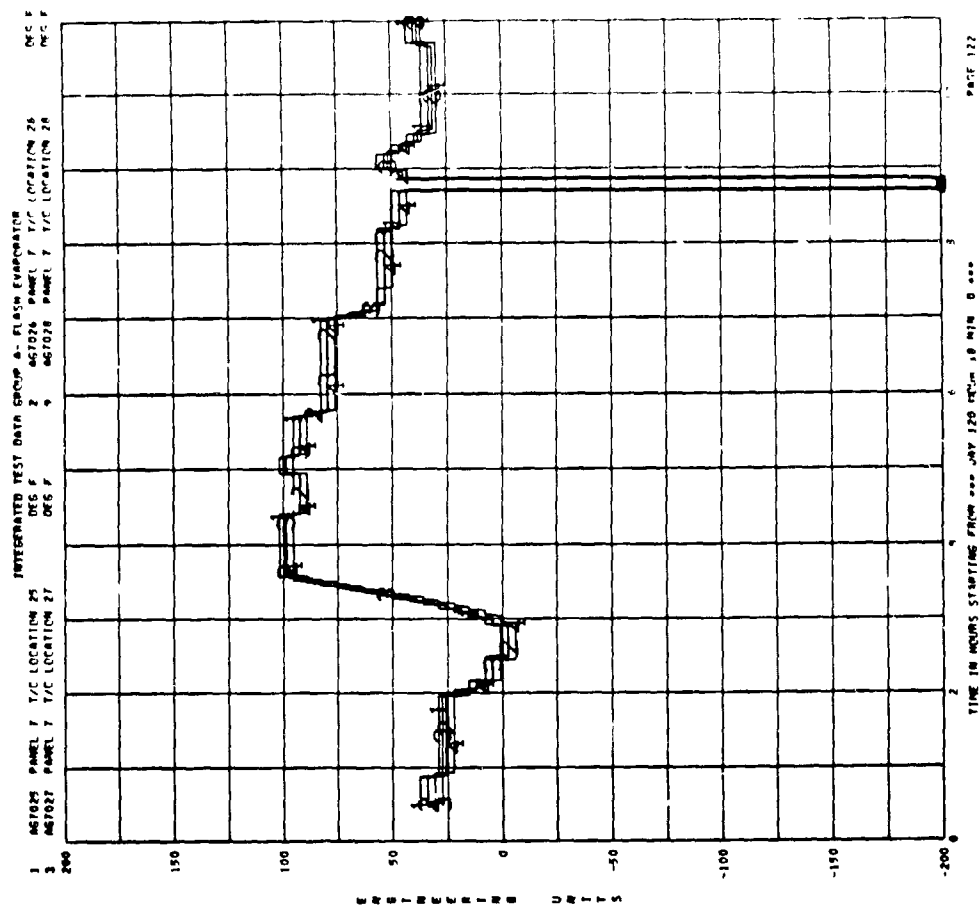
A-119



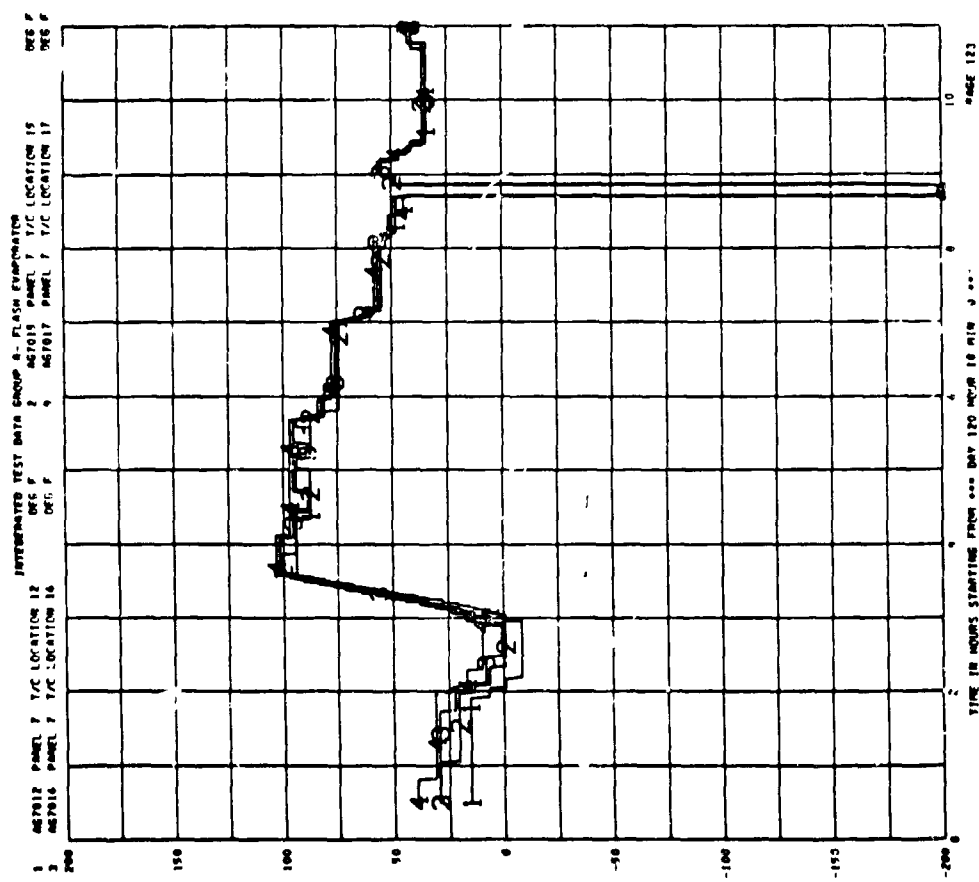
A-120



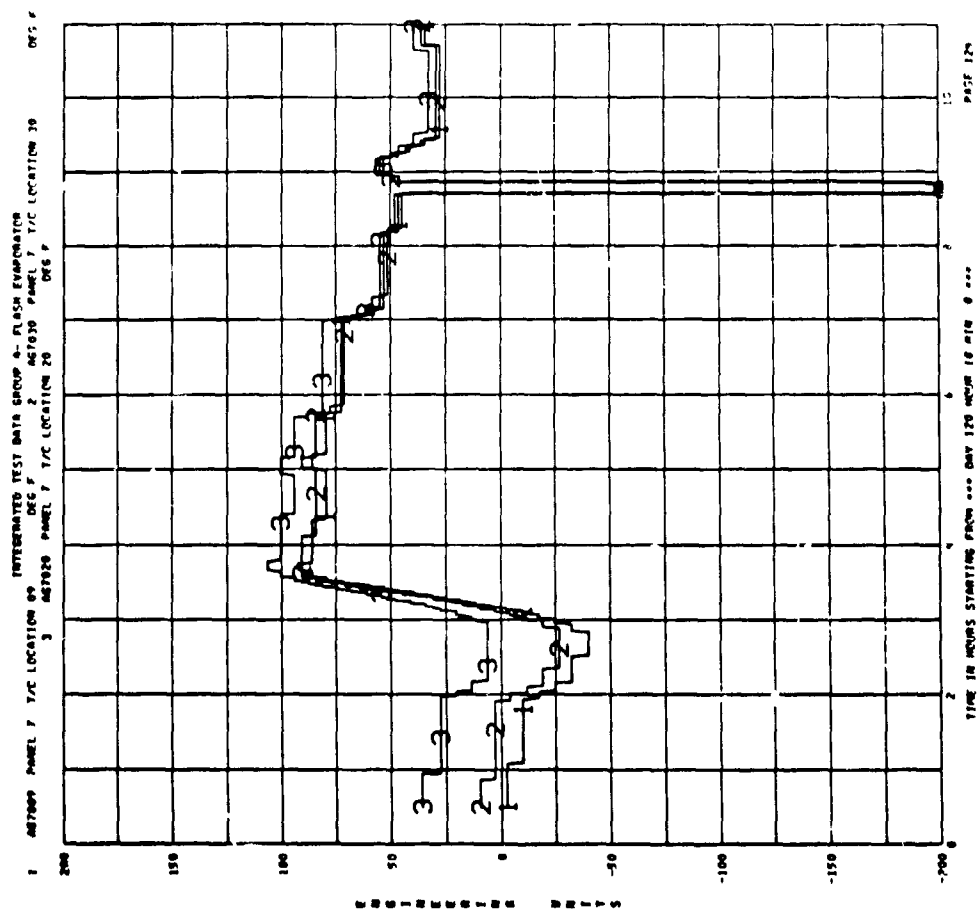
A-121



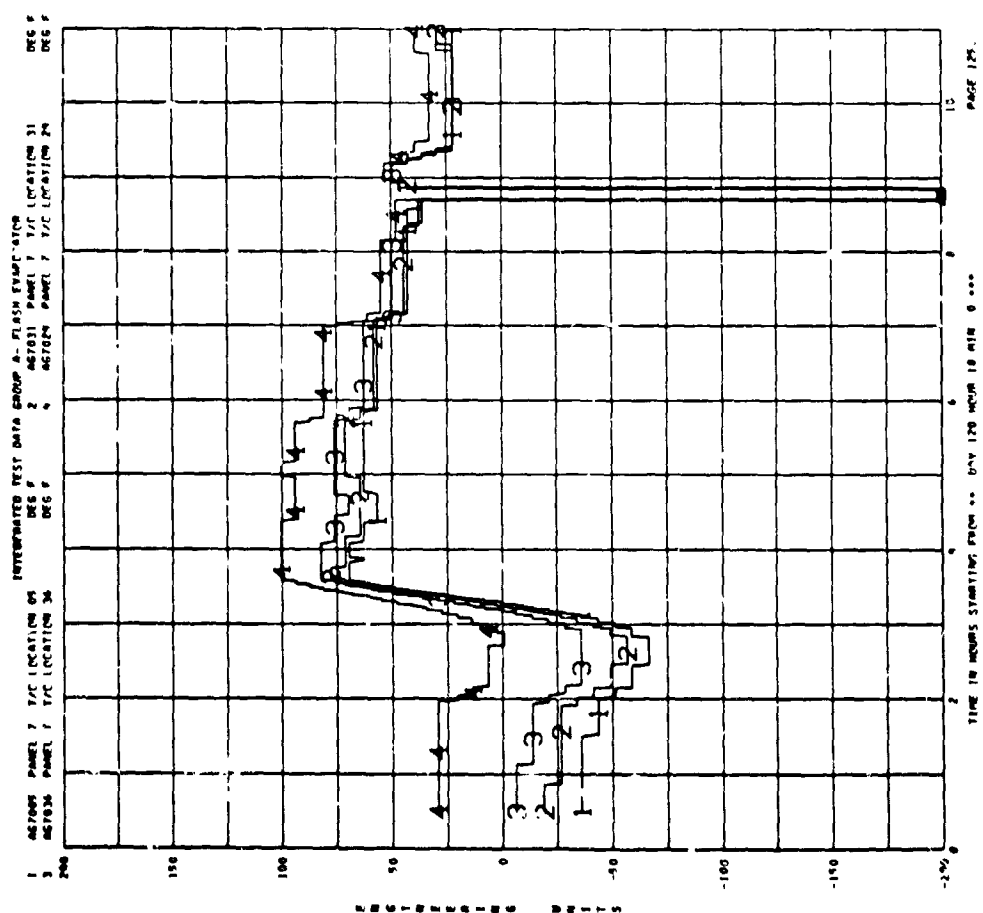
A-122



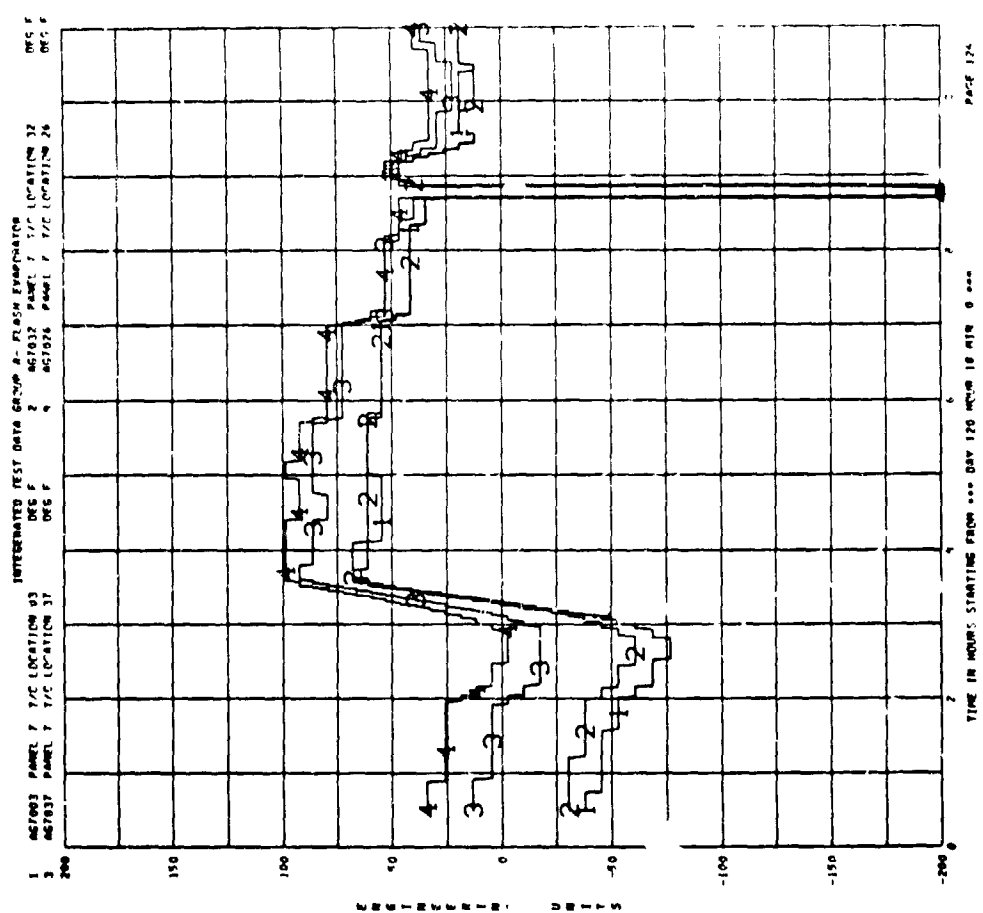
A-123



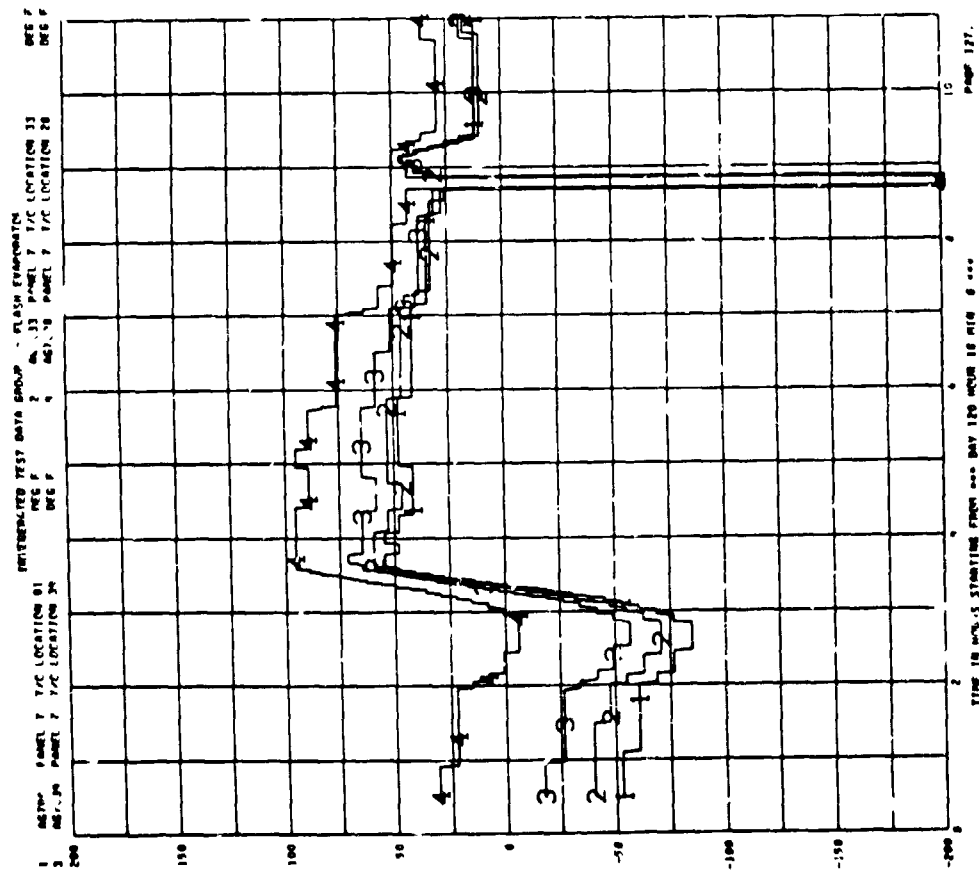
A-124



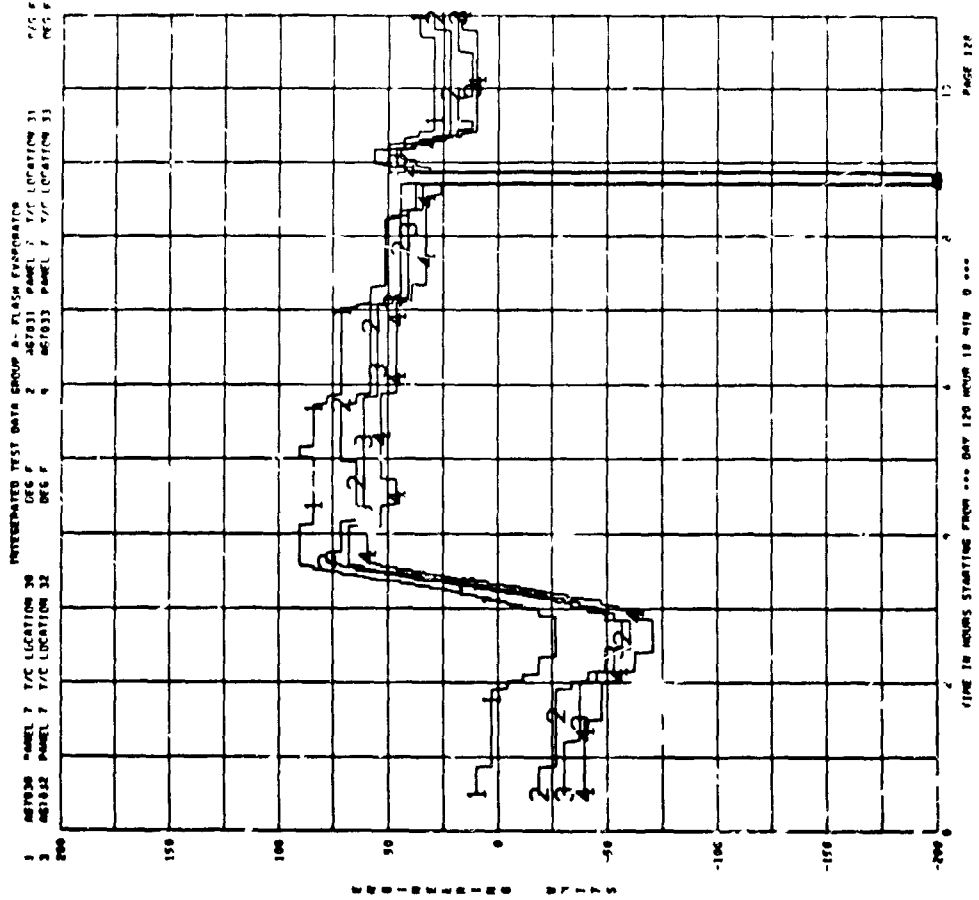
A-125



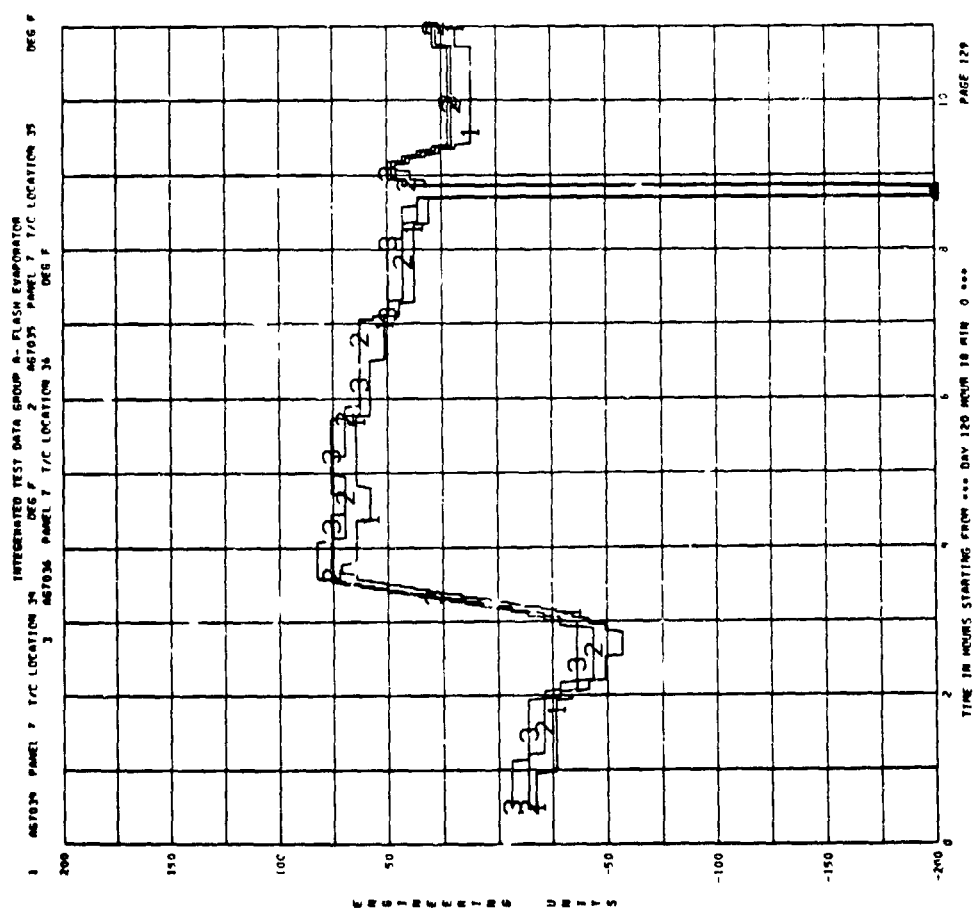
A-126



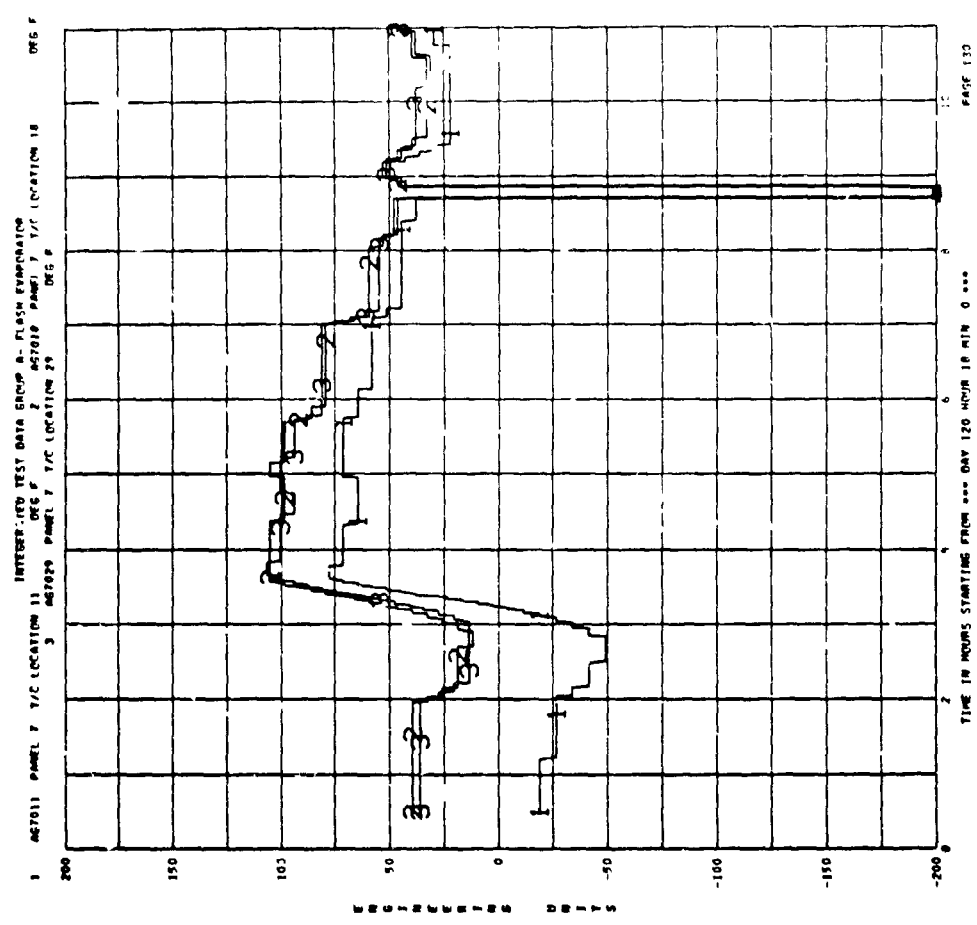
A-127



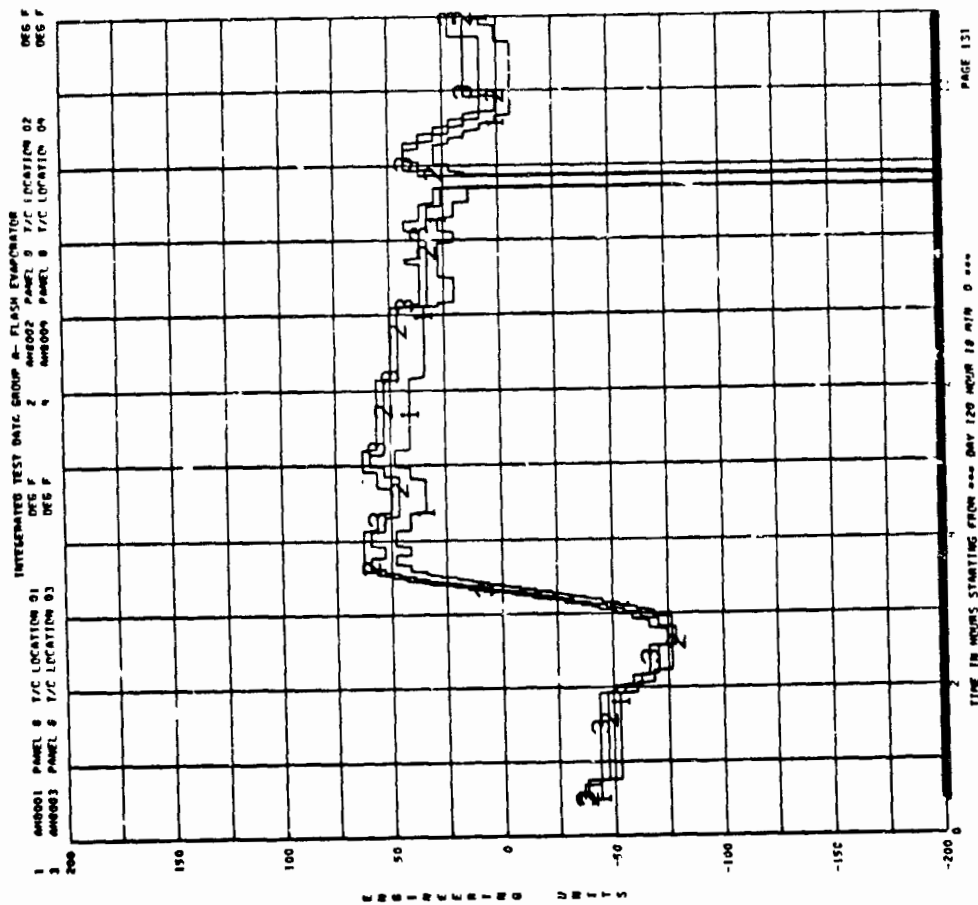
A-128



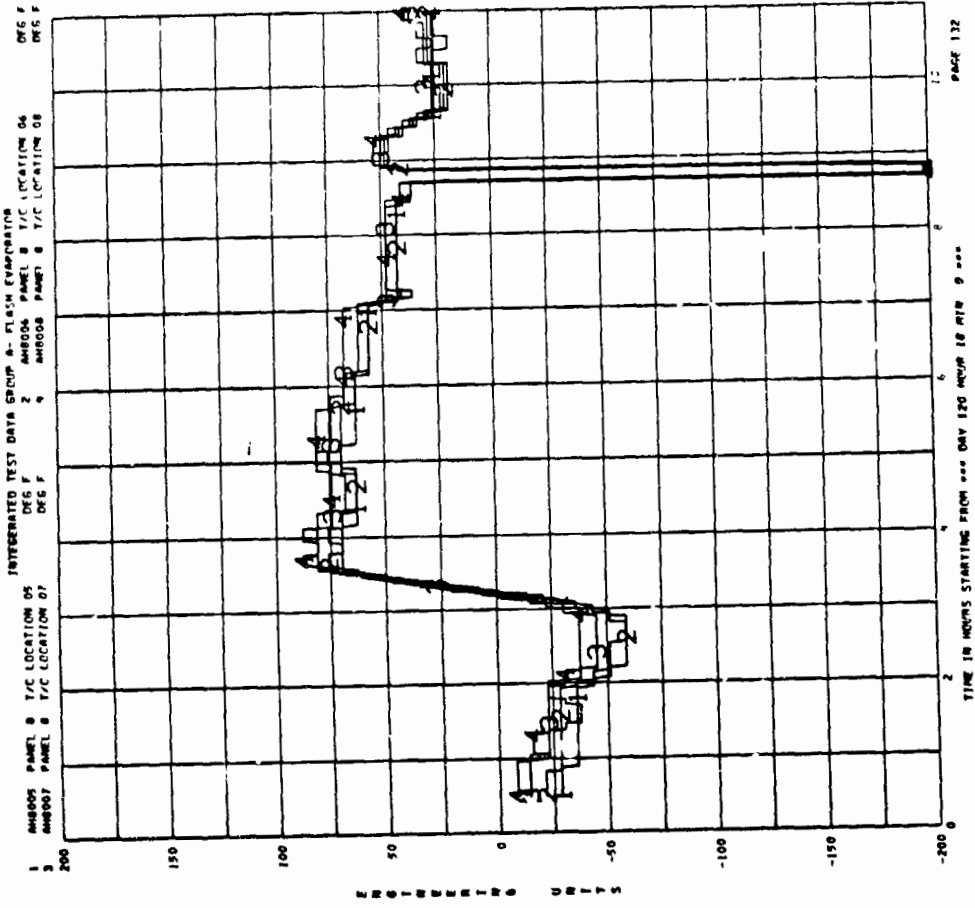
A-129



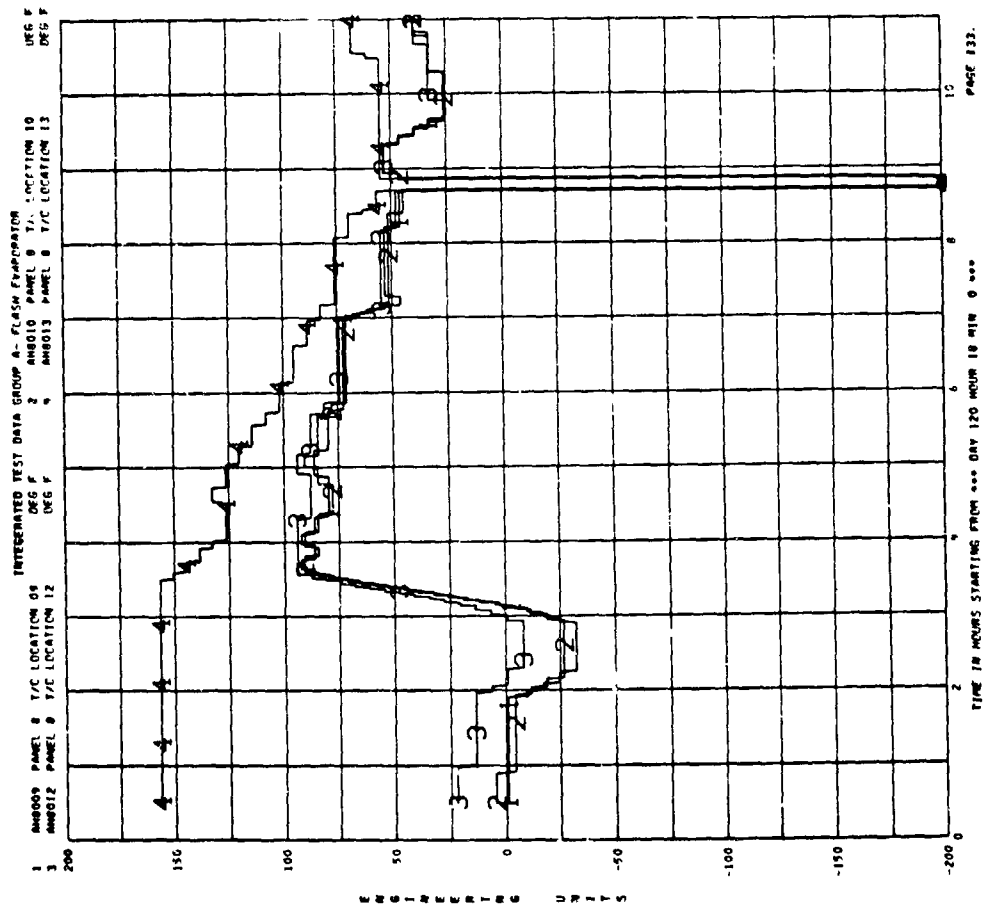
A-130



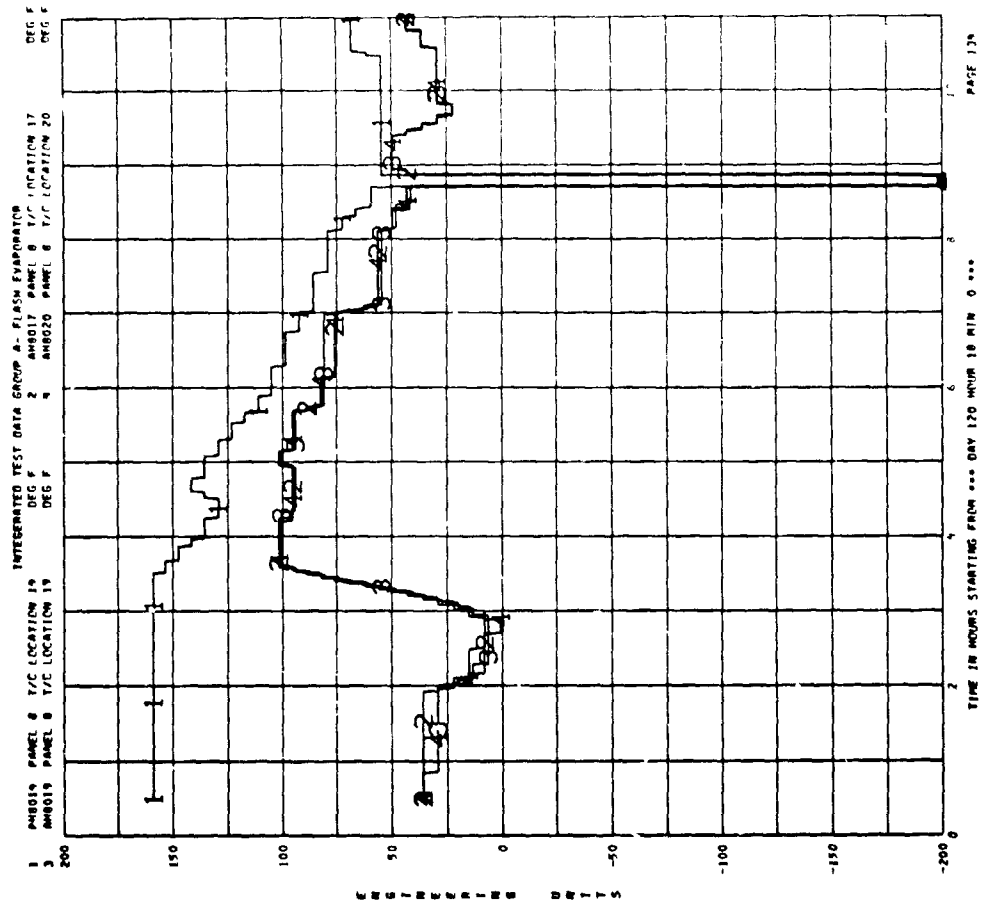
A-131



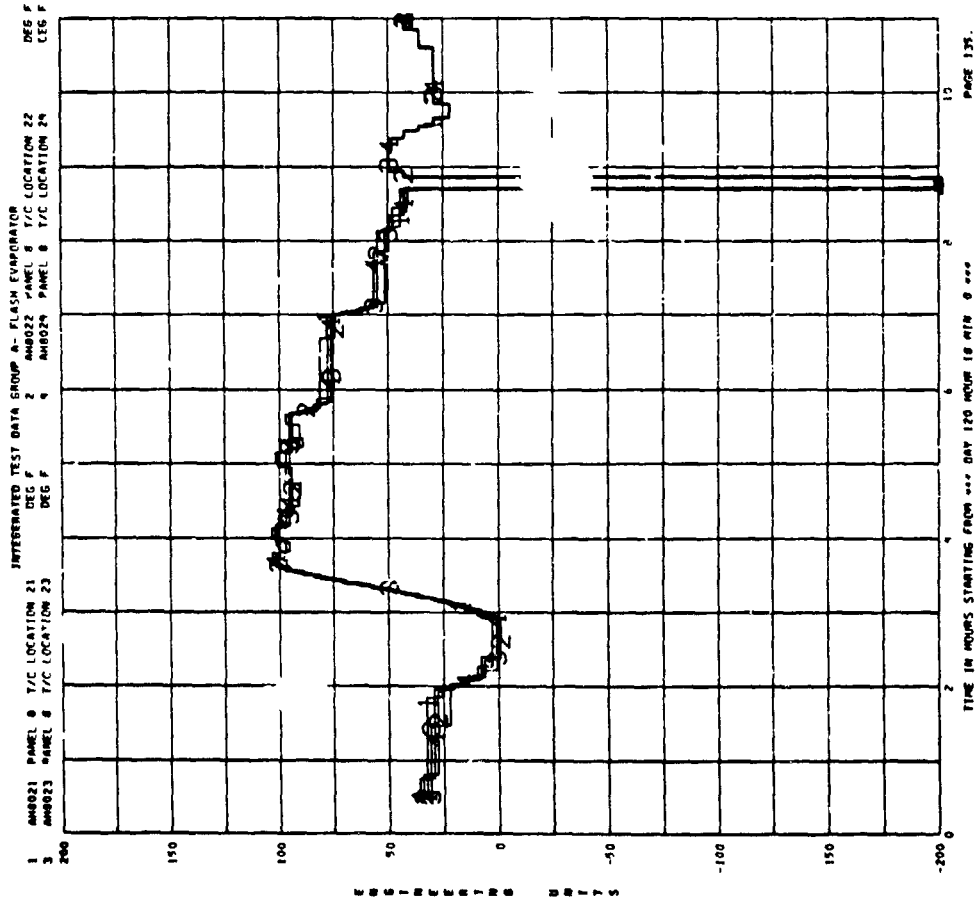
A-132



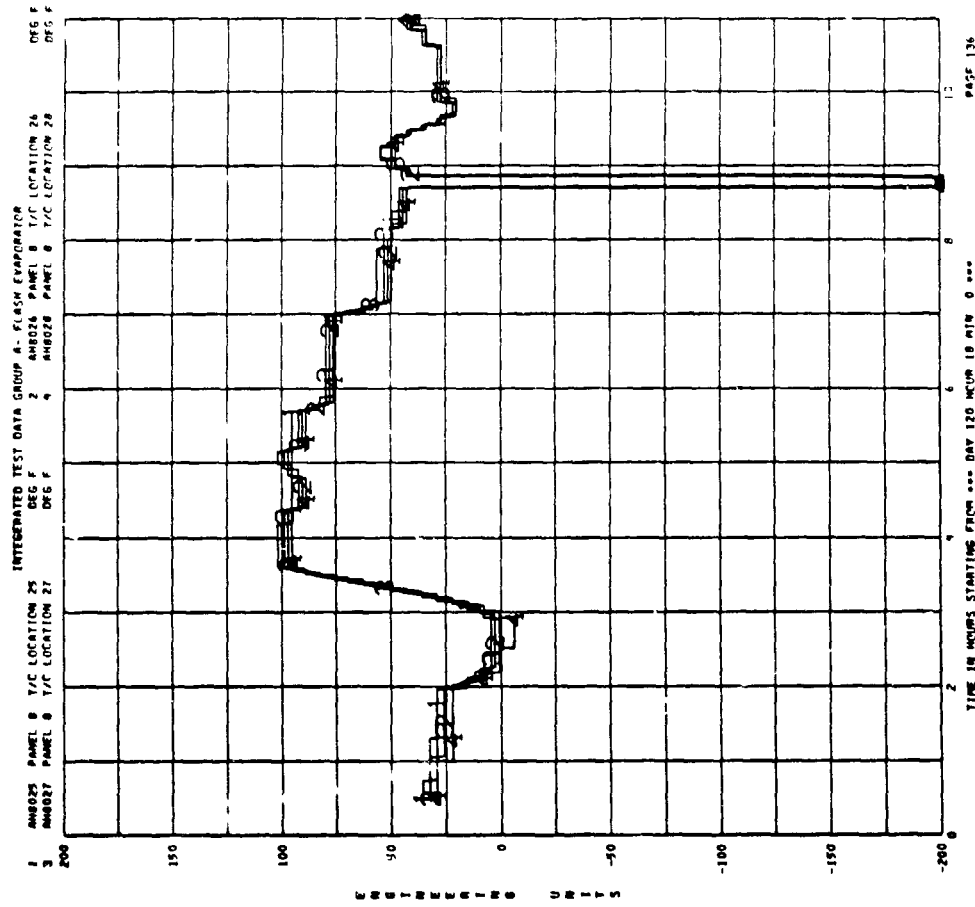
A-133



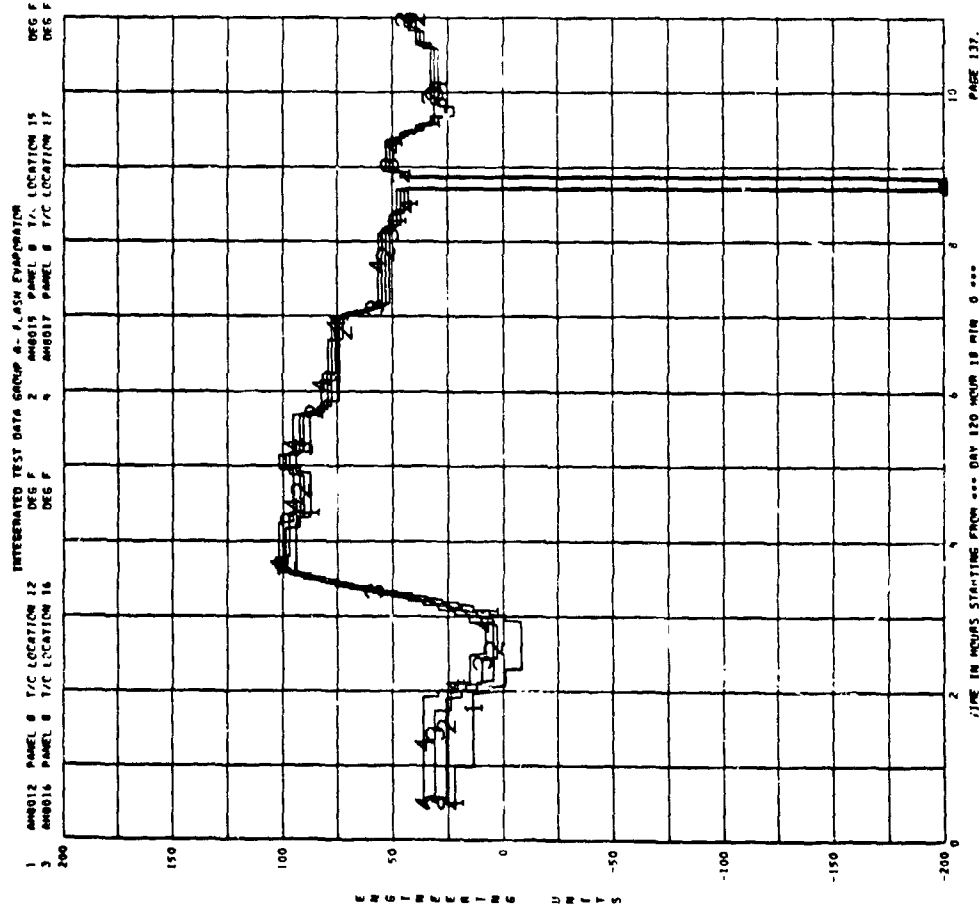
A-134



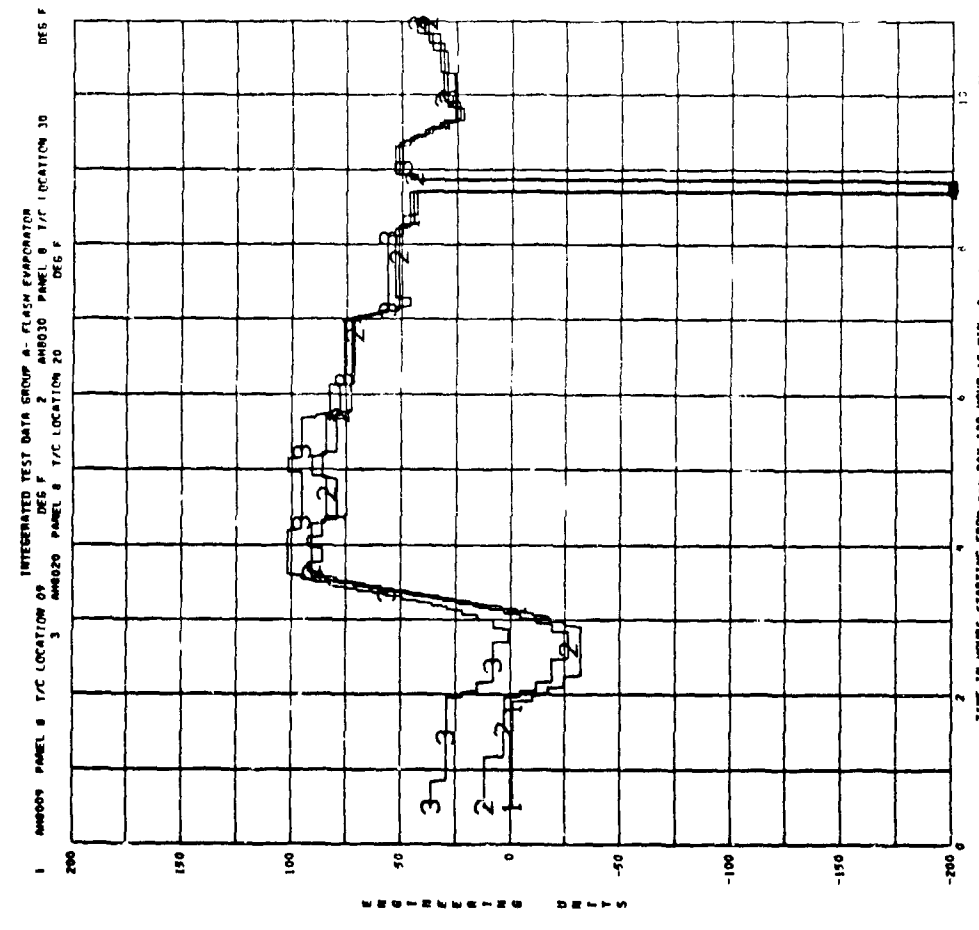
A-135



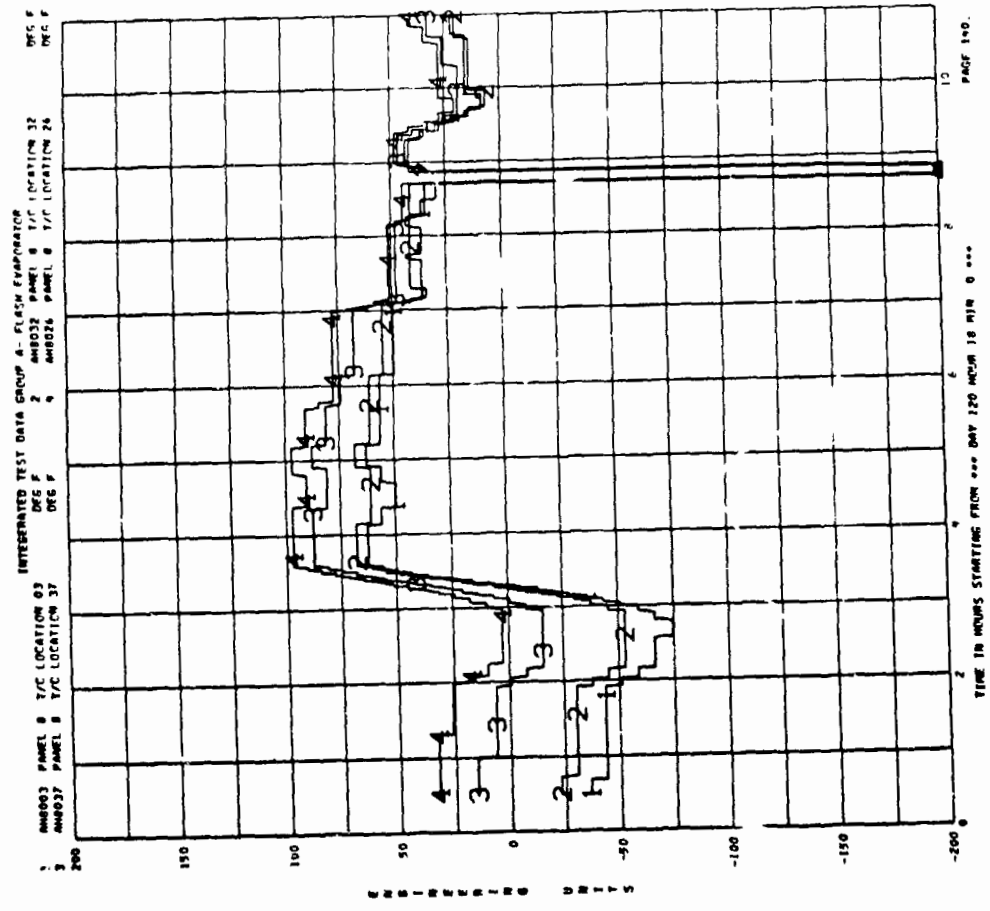
A-136



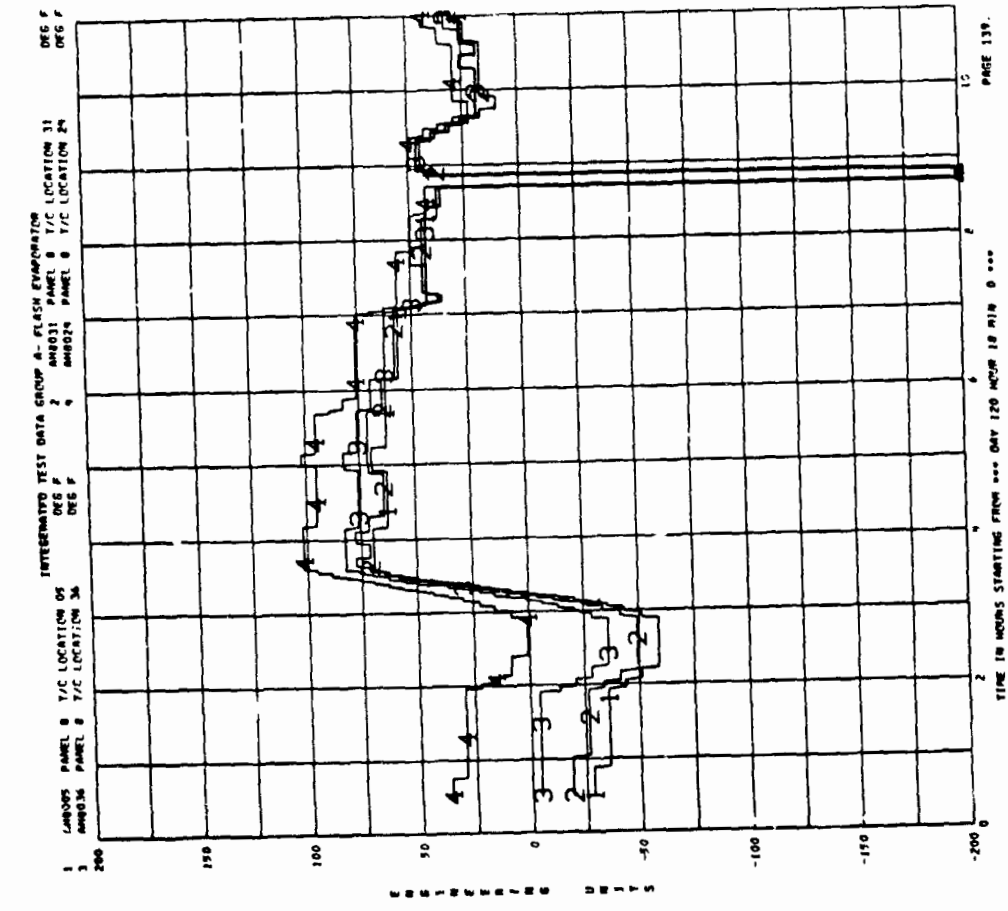
A-137



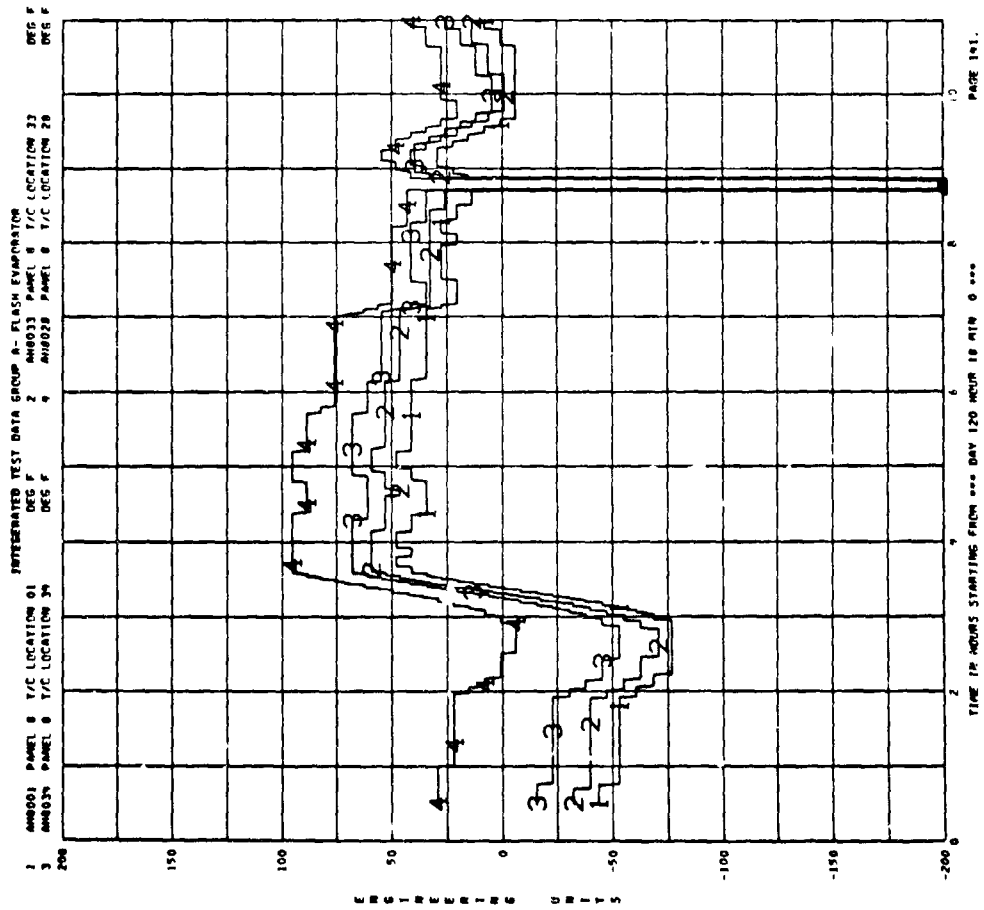
A-138



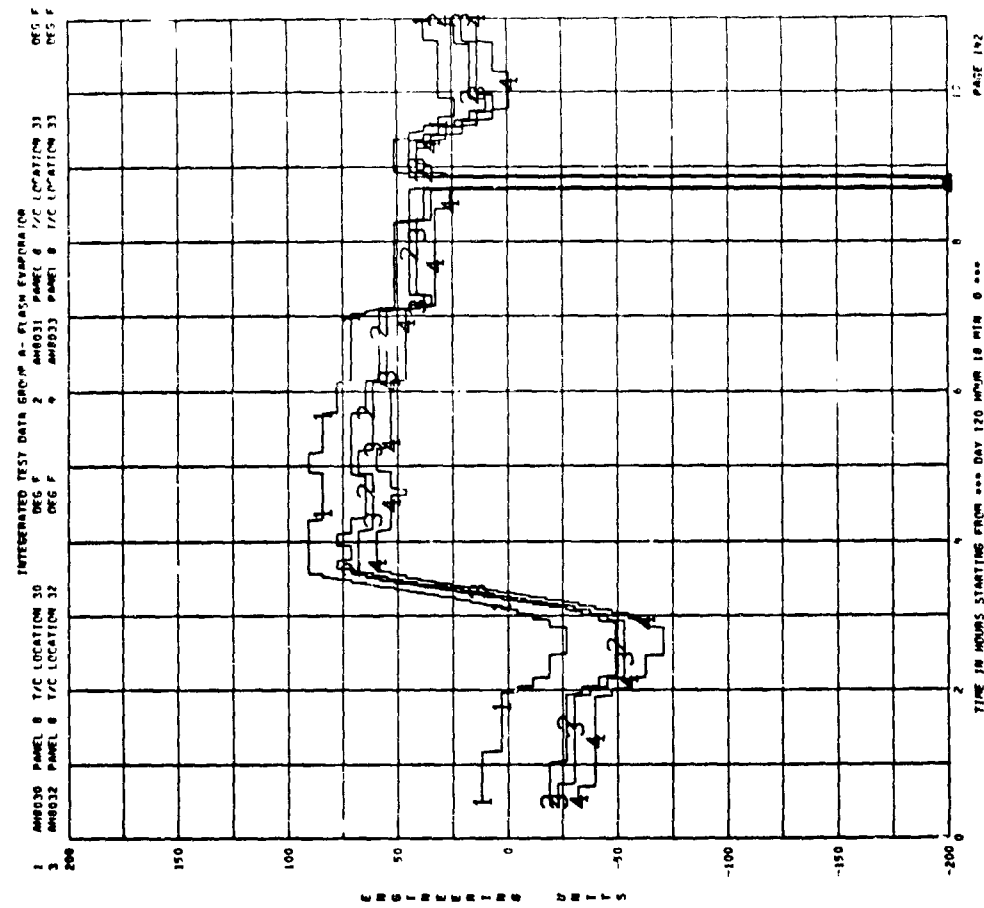
A-140



A-139

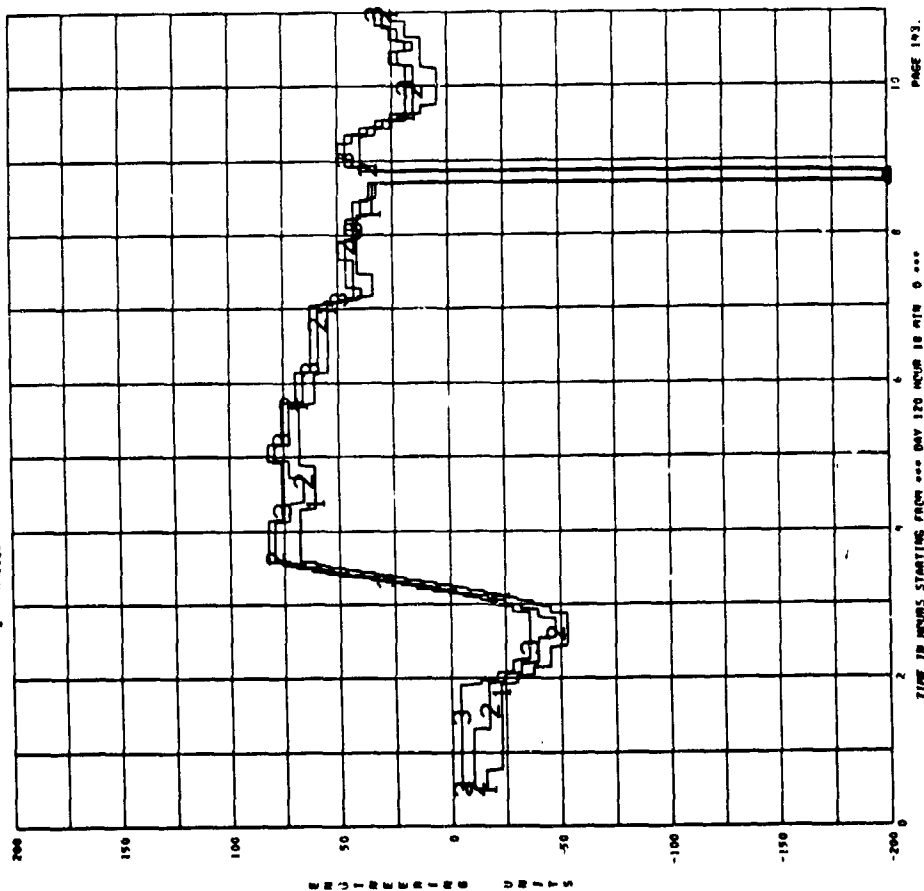


A-141



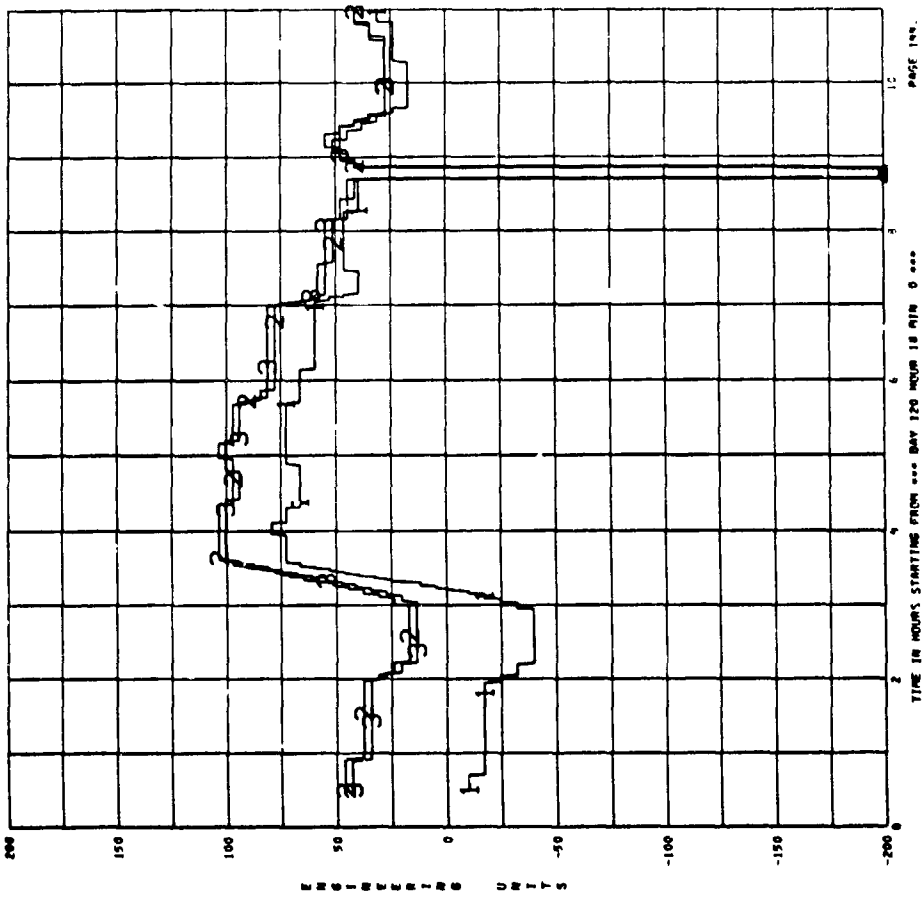
A-142

INTERGRATED TEST DATA GROUP A- FLASH EVAPORATOR
 1 AM0034 PANEL 8 T/C LOCATION 34 DEG F
 2 AM0034 PANEL 9 T/C LOCATION 35 DEG F
 3 AM0034 PANEL 6 T/C LOCATION 36 DEG F



A-143

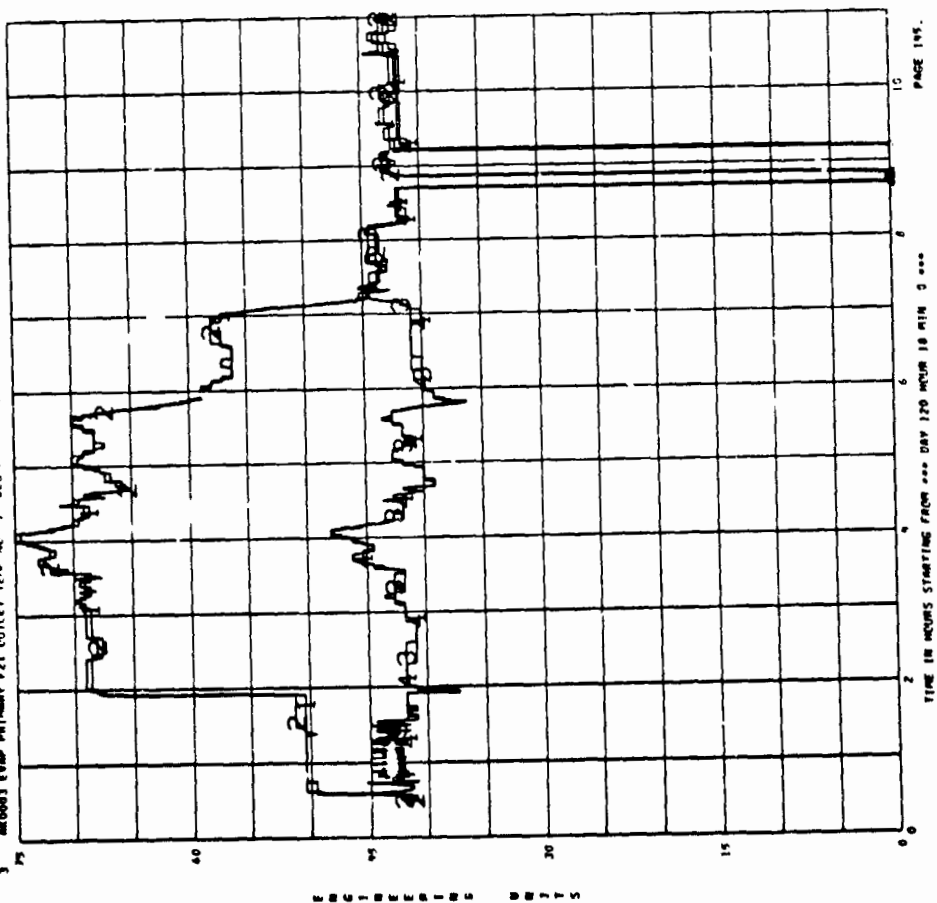
INTERGRATED TEST DATA GROUP A- FLASH EVAPORATOR
 1 AM0011 PANEL 8 T/C LOCATION 11 DEG F
 2 AM0018 PANEL 8 T/C LOCATION 18 DEG F
 3 AM0029 PANEL 6 T/C LOCATION 29 DEG F



A-144

INTERGENERATED TEST DATA GROUP A- FLASH EVAPORATION

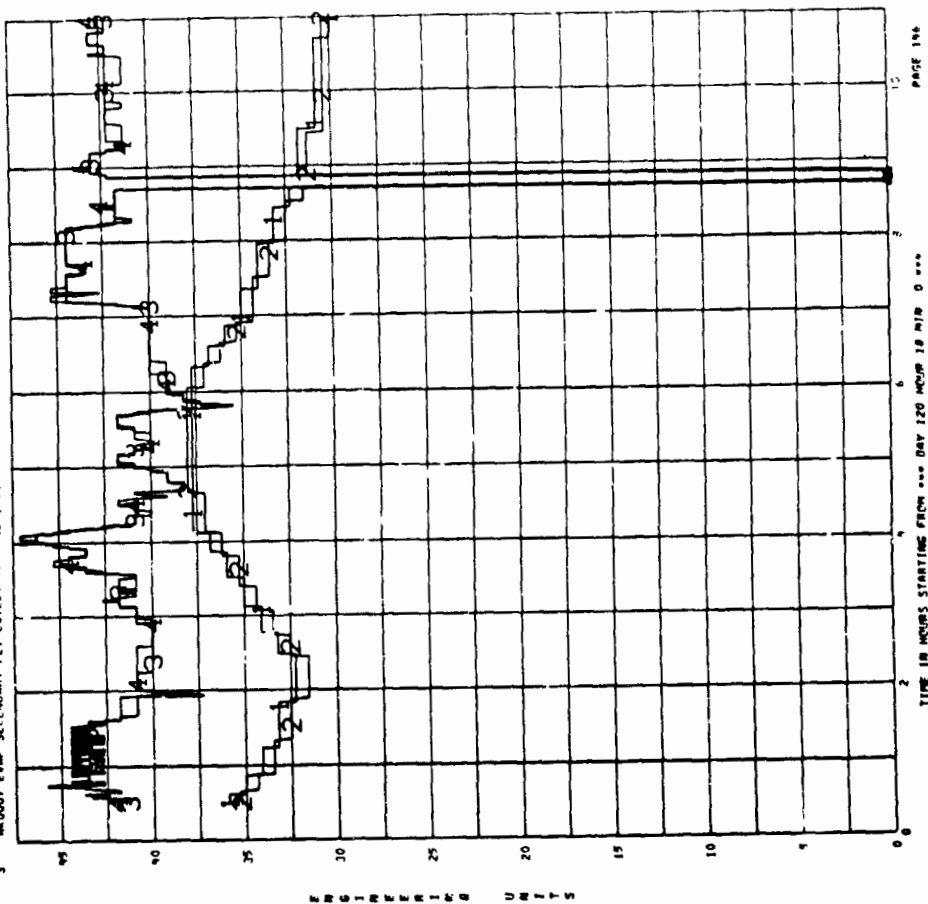
1 M00001 EVAP PRIMARY F21 INLET TEMP NO. 1 DEG F 2 M00002 EVAP PRIMARY F21 INLET TEMP NO. 2 DEG F
 3 M00003 EVAP PRIMARY F21 OUTLET TEMP NO. 1 DEG F 4 M00004 EVAP PRIMARY F21 OUTLET TEMP NO. 2 DEG F



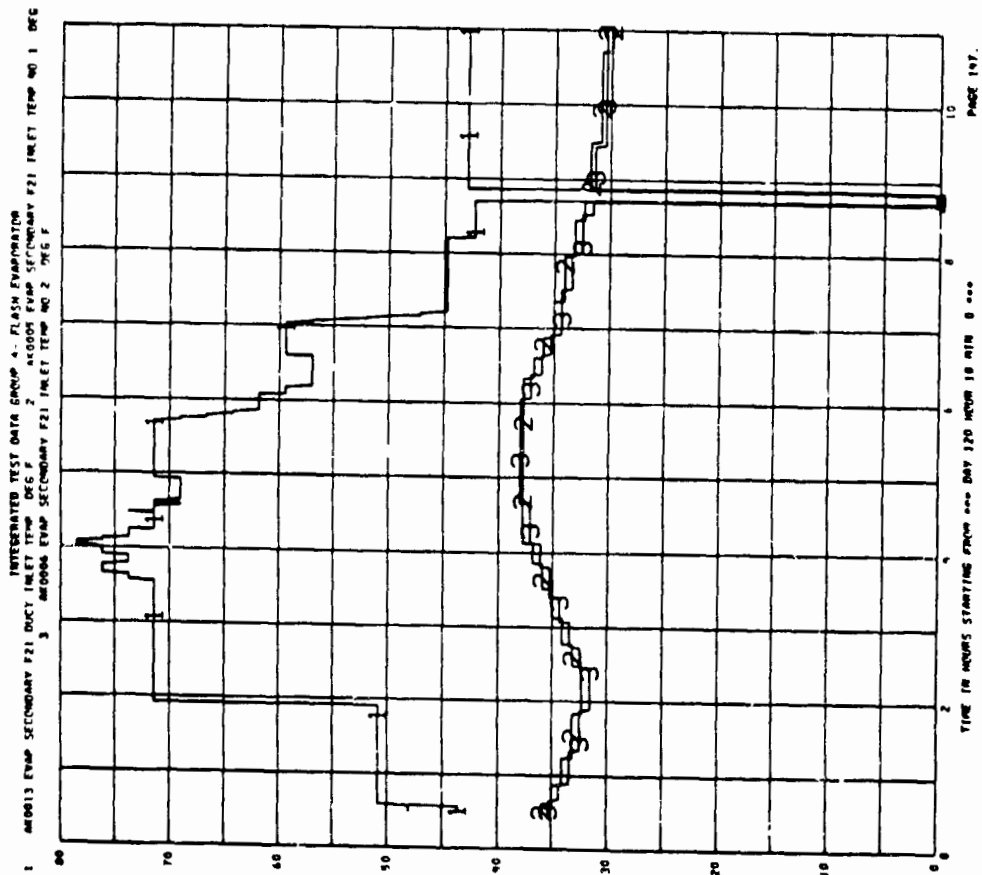
A-145

INTERGENERATED TEST DATA GROUP A- FLASH EVAPORATION

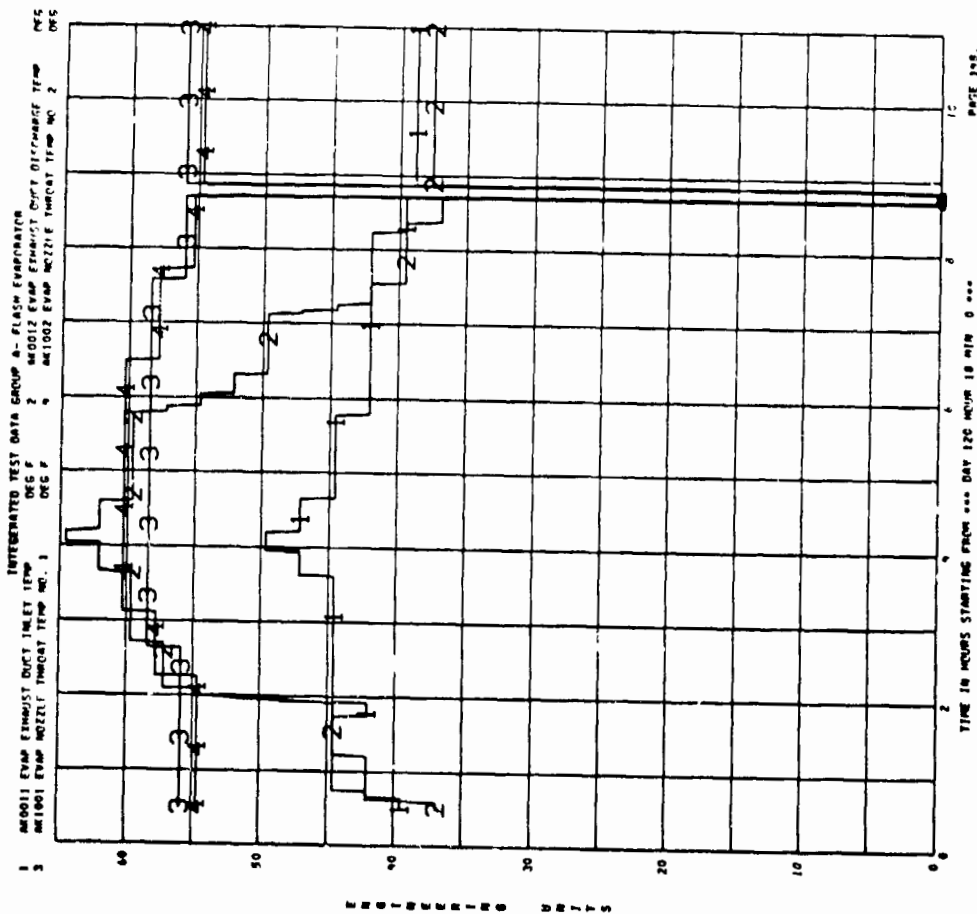
1 M00005 EVAP SECONDARY F21 INLET TEMP NO. 1 DEG F 2 M00006 EVAP SECONDARY F21 INLET TEMP NO. 2 DEG F
 3 M00007 EVAP SECONDARY F21 OUTLET TEMP NO. 1 DEG F 4 M00008 EVAP SECONDARY F21 OUTLET TEMP NO. 2 DEG F



A-146

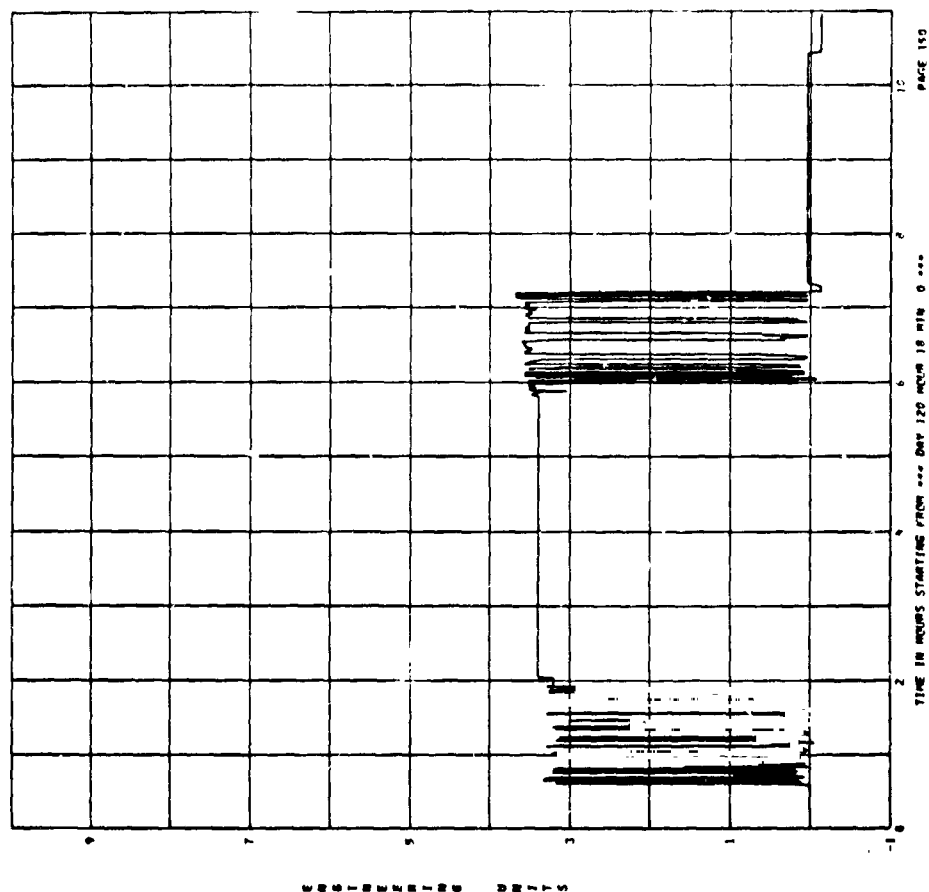


A-147



A-148

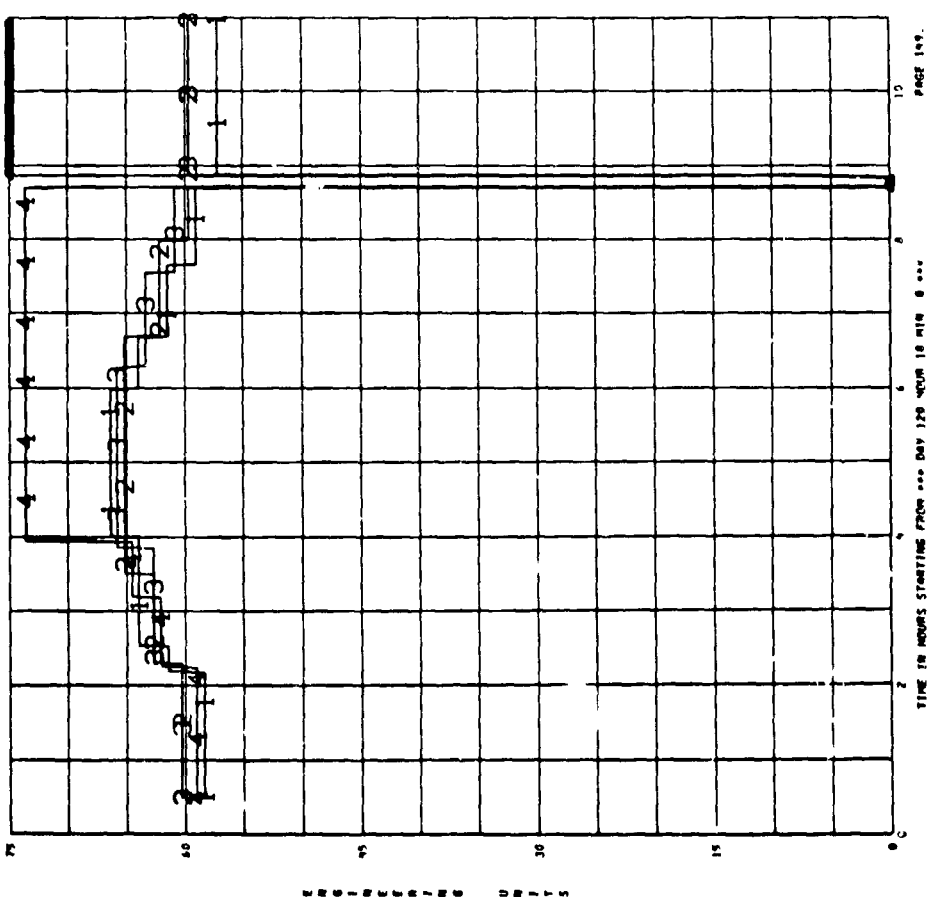
INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION
 1 100001 EVAP CHAMBER PRESSURE



A-150

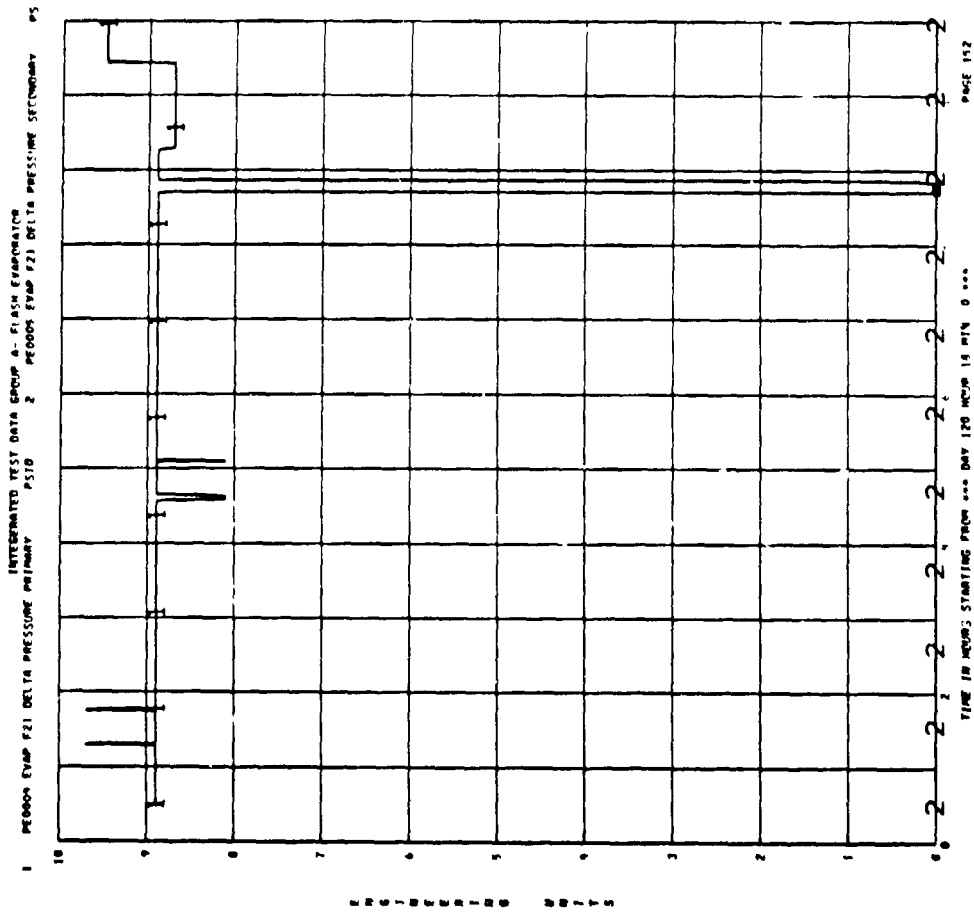
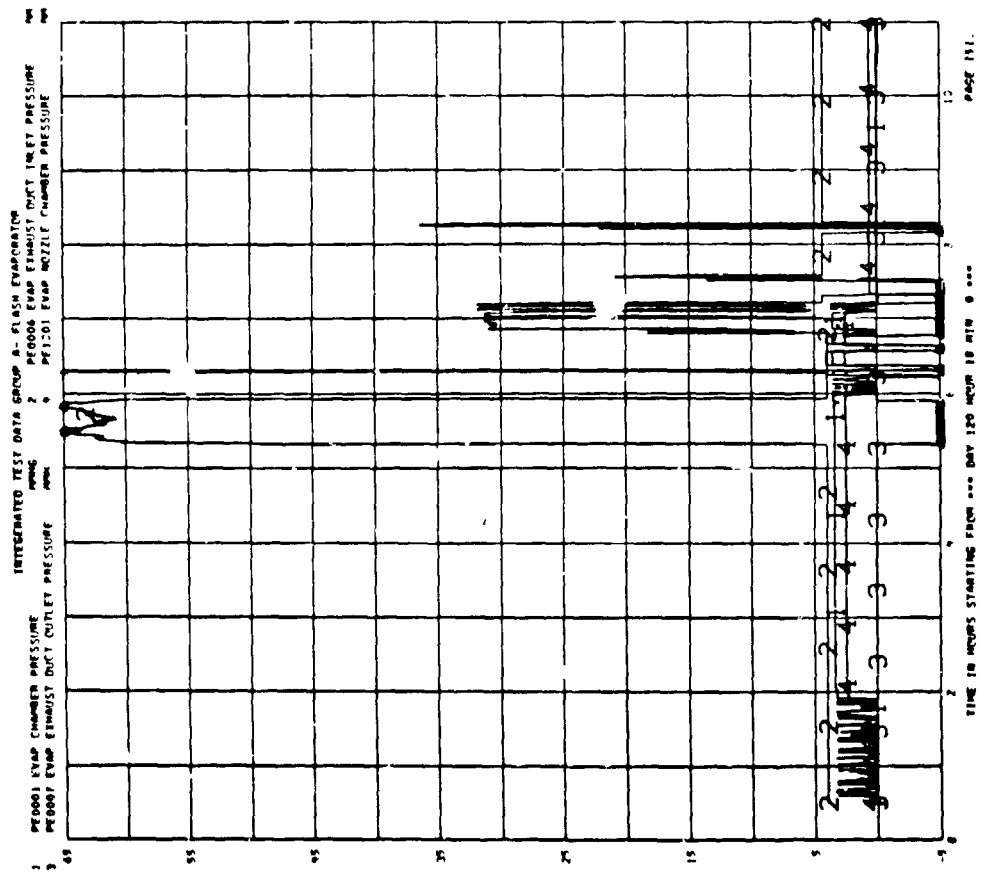
PAGE 150

INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION
 1 001203 EVAP NOZZLE CHAMBER TEMP NO 1 DEG F
 2 001204 EVAP NOZZLE CHAMBER TEMP NO 2 DEG F
 3 001205 EVAP NOZZLE CHAMBER TEMP NO 3 DEG F
 4 001206 EVAP NOZZLE CHAMBER TEMP NO 4 DEG F

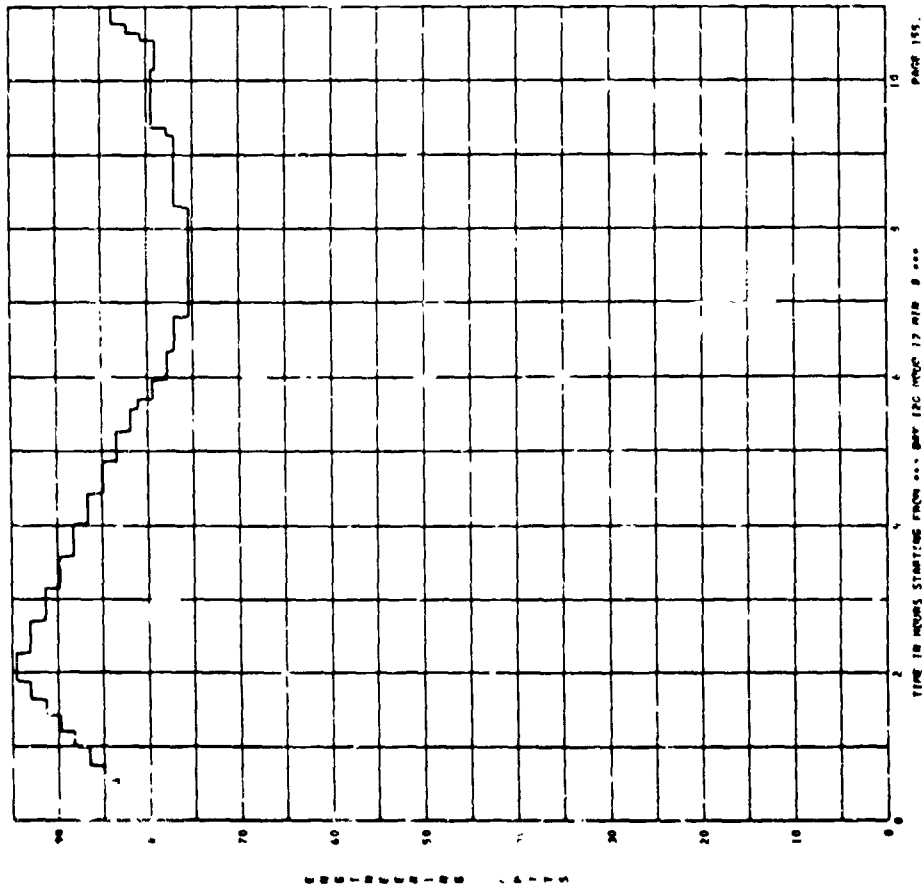


A-149

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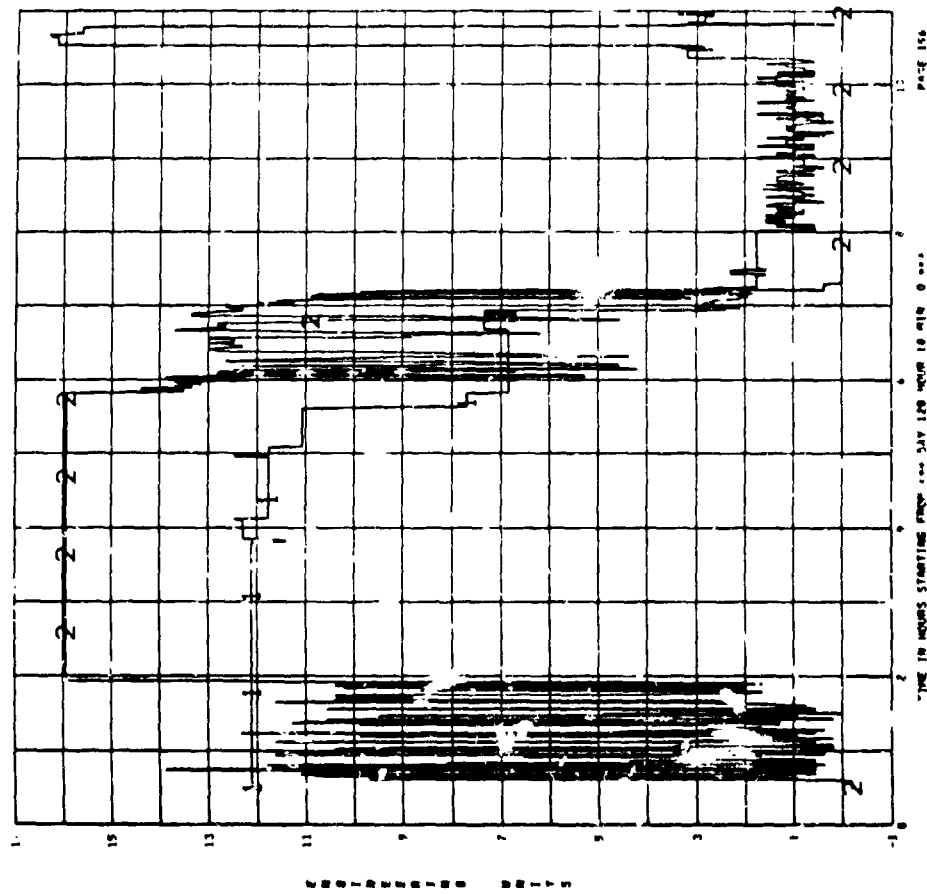


1 INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION
LEAD001 EVAP H2O TIME QUANTITY



A-155

1 INTEGRATED TEST DATA GROUP A- FLASH EVAPORATION
LEAD001 H2O FLOW INTO TANK
2 LEAD002 H2O FLOW FROM TANK TO PUMP ON SUBJ 1057

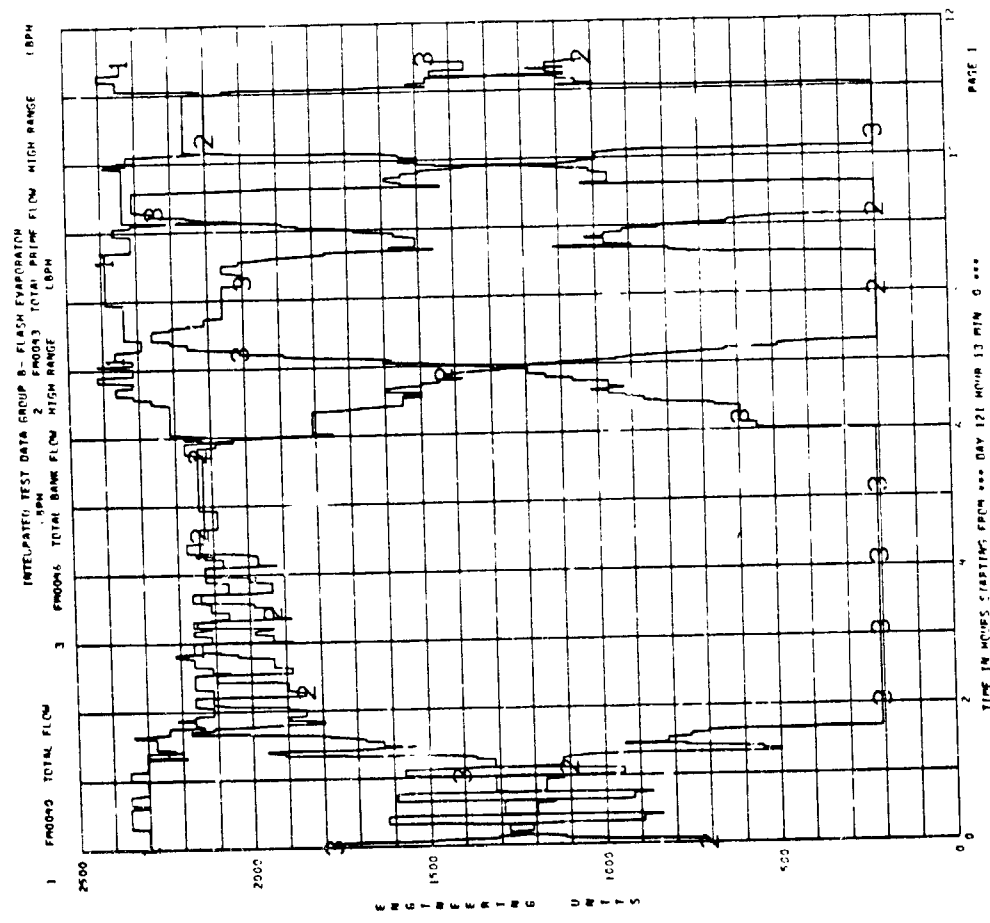
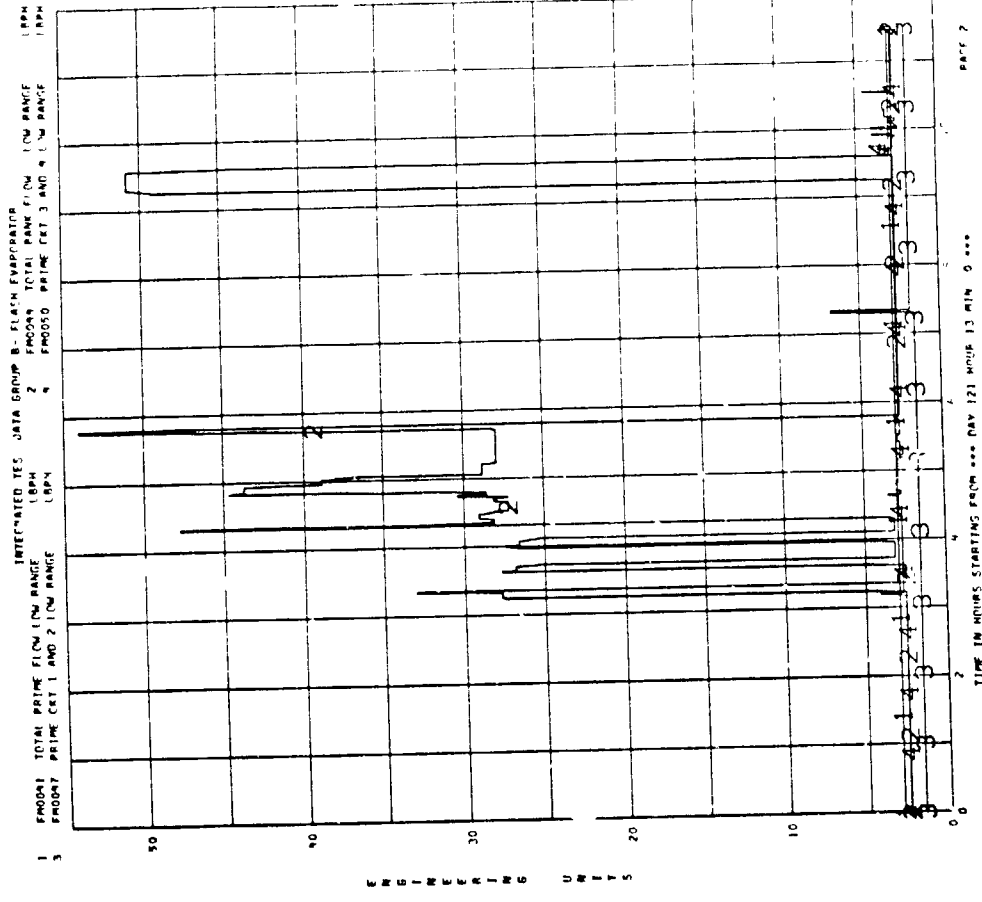


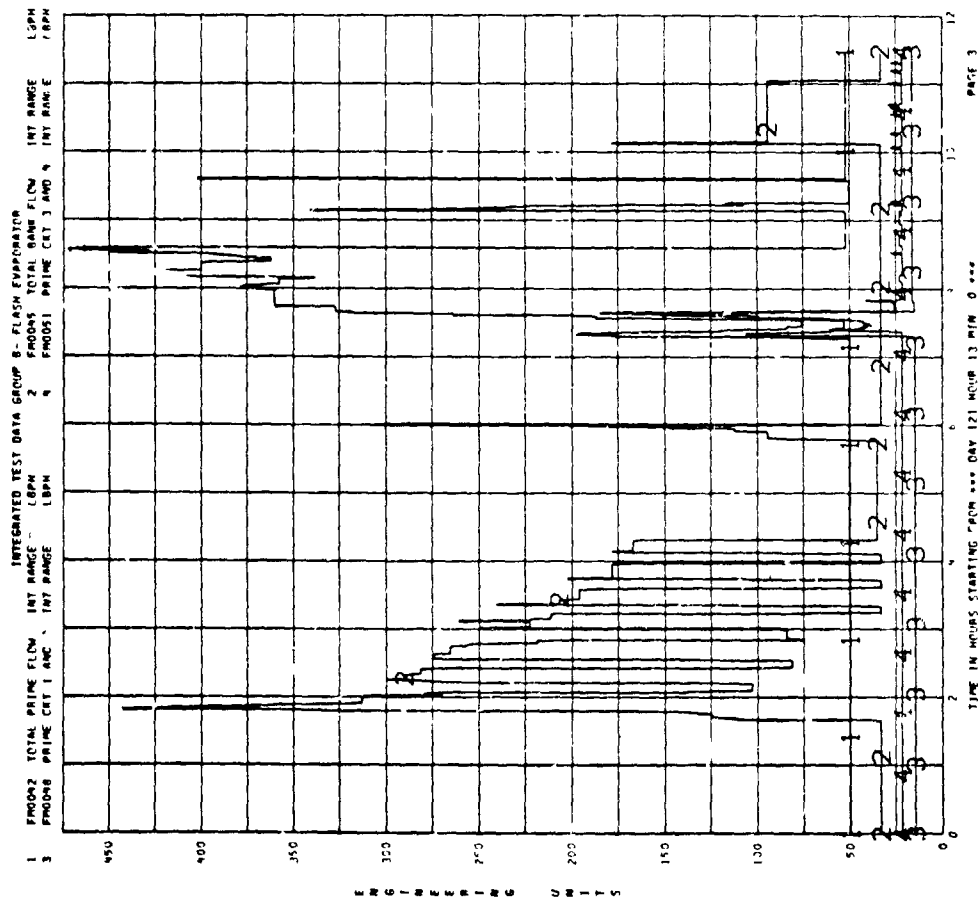
A-156

DATA GROUP B

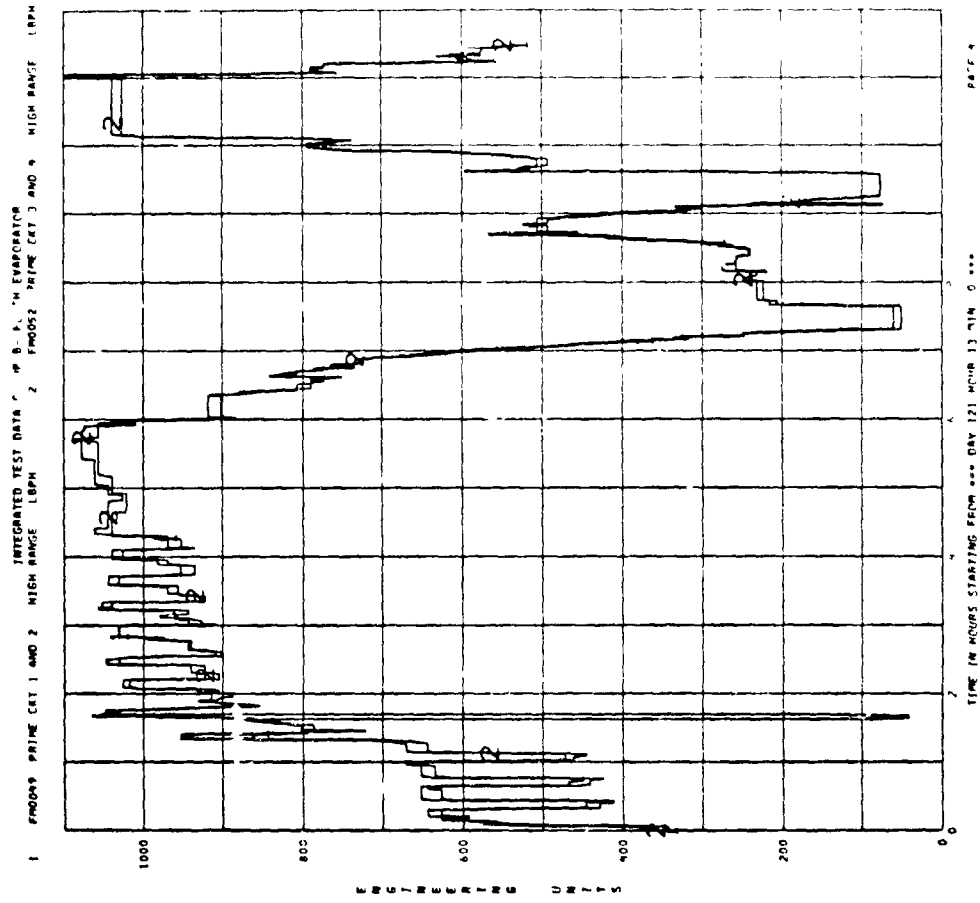
TEST POINTS 8-14

From Day 121, 1300 to Day 122, 0030

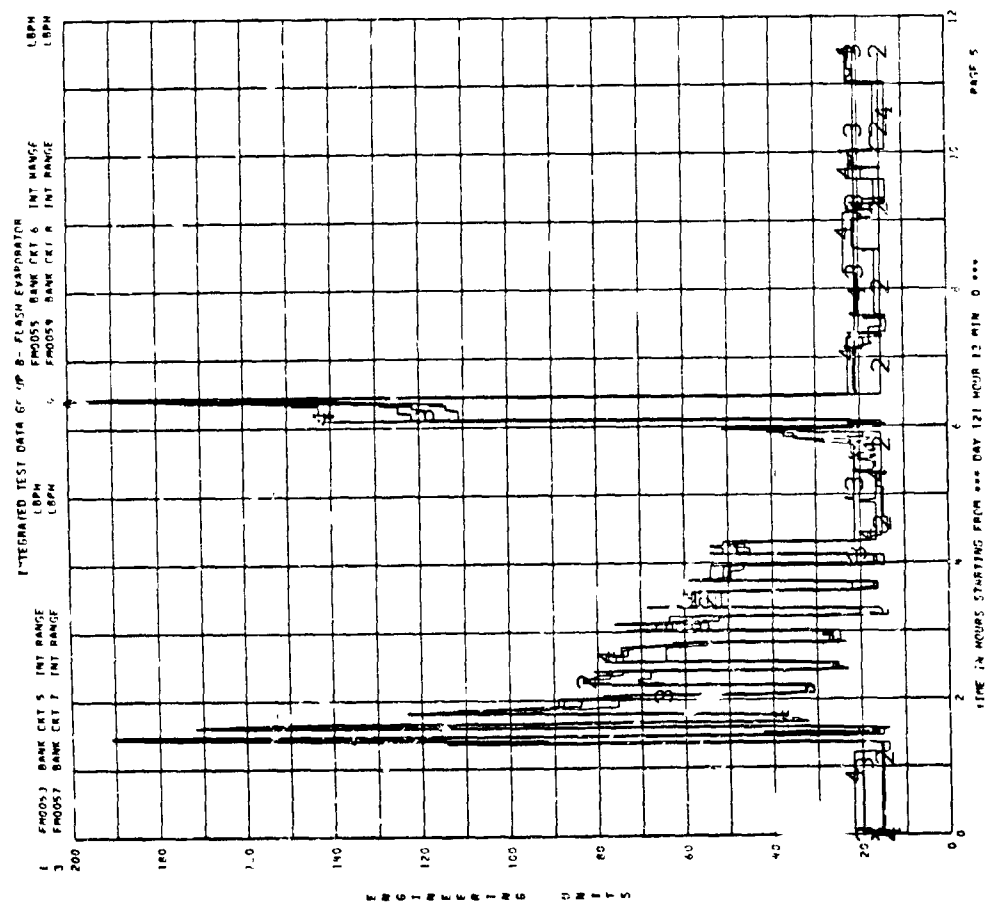




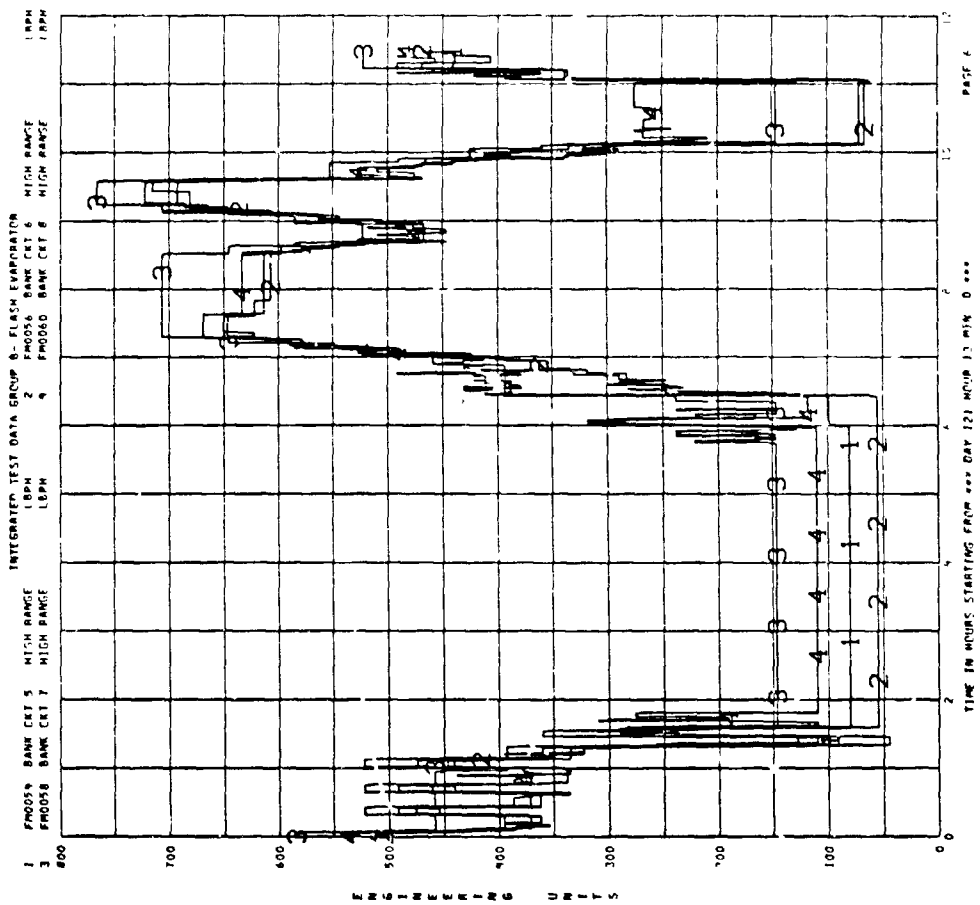
B-3



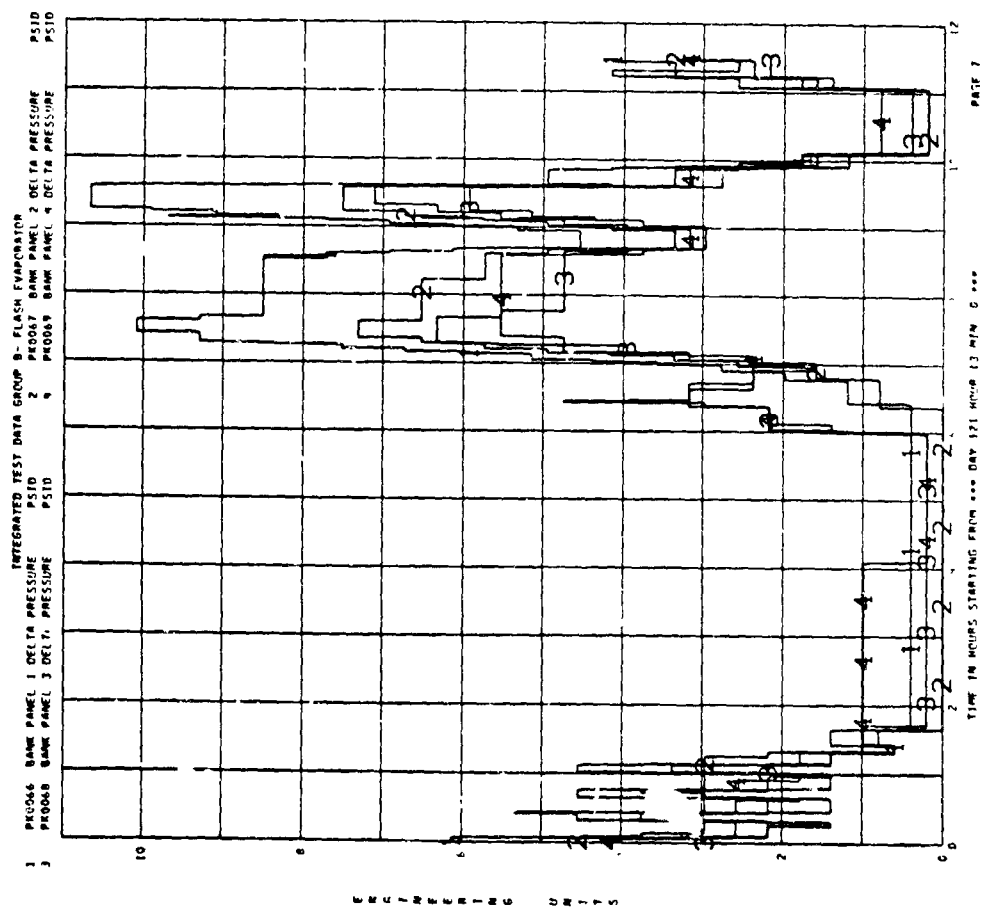
B-4



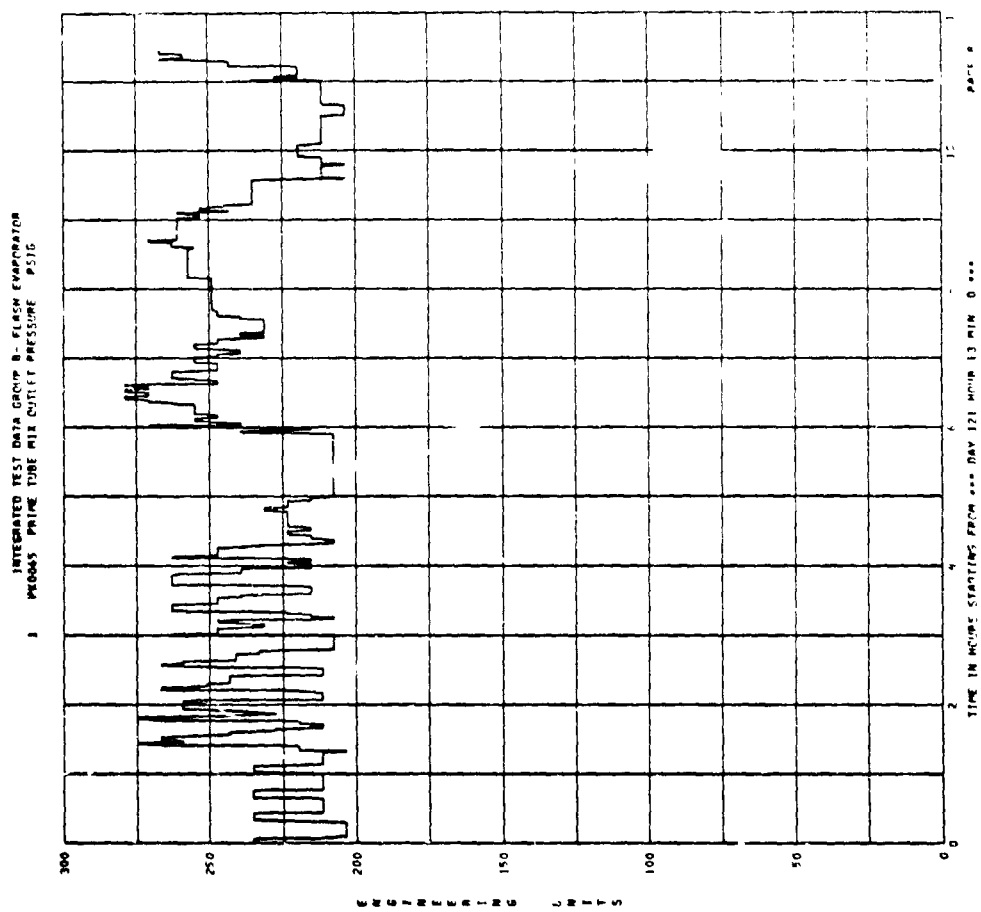
B-5



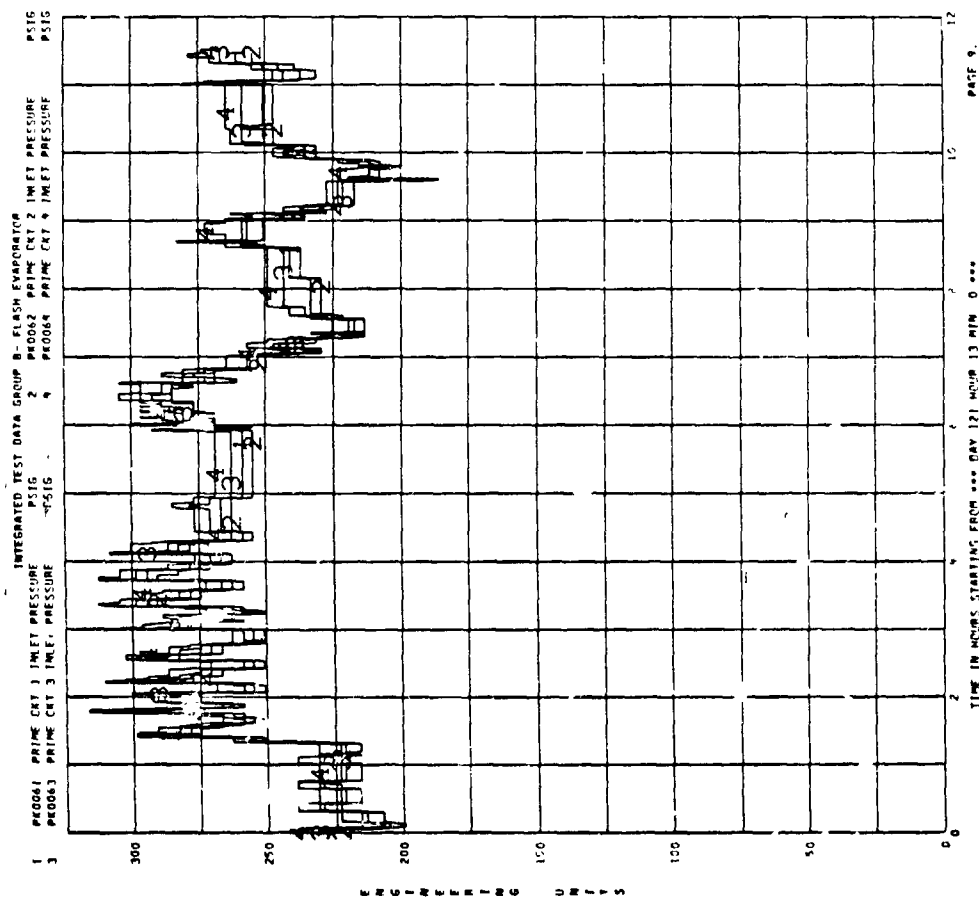
B-6



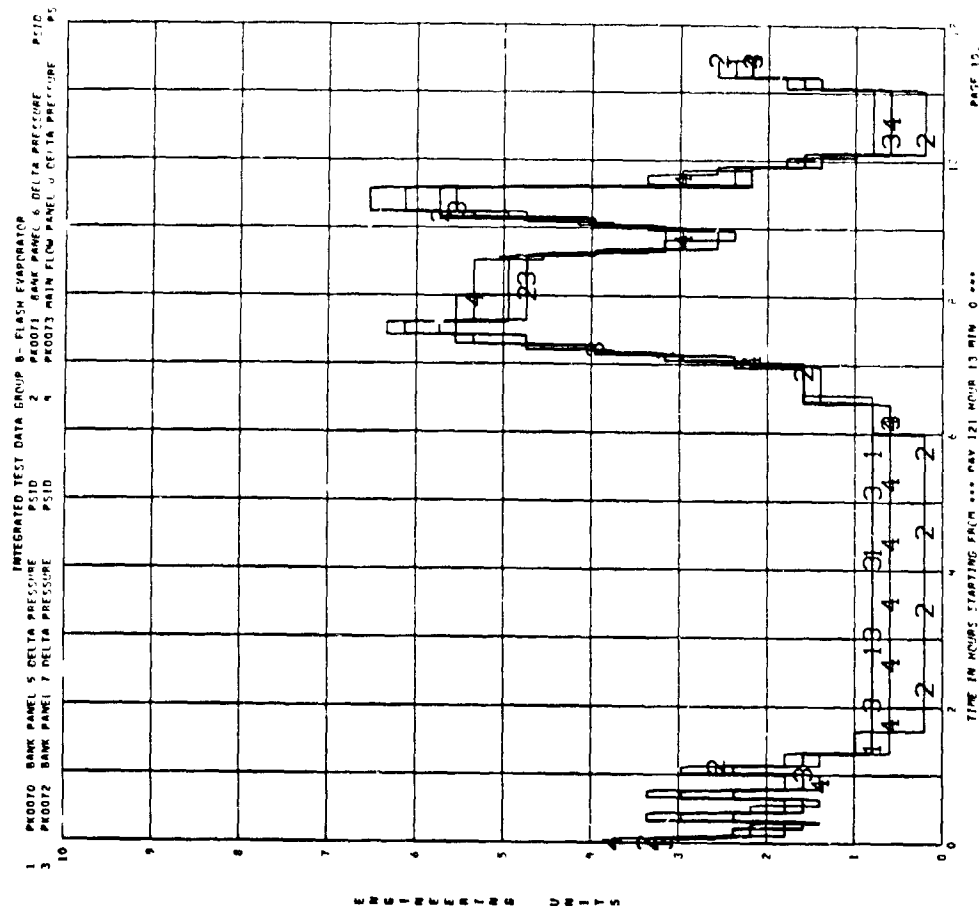
B-7



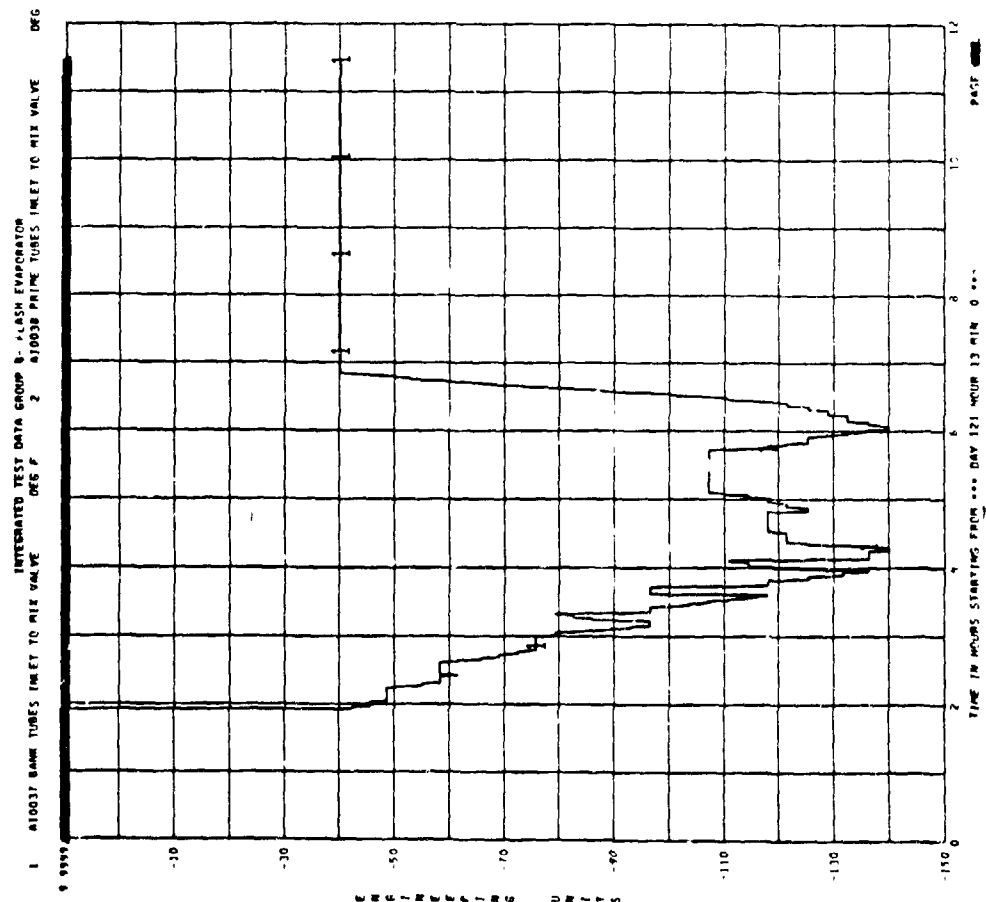
B-8



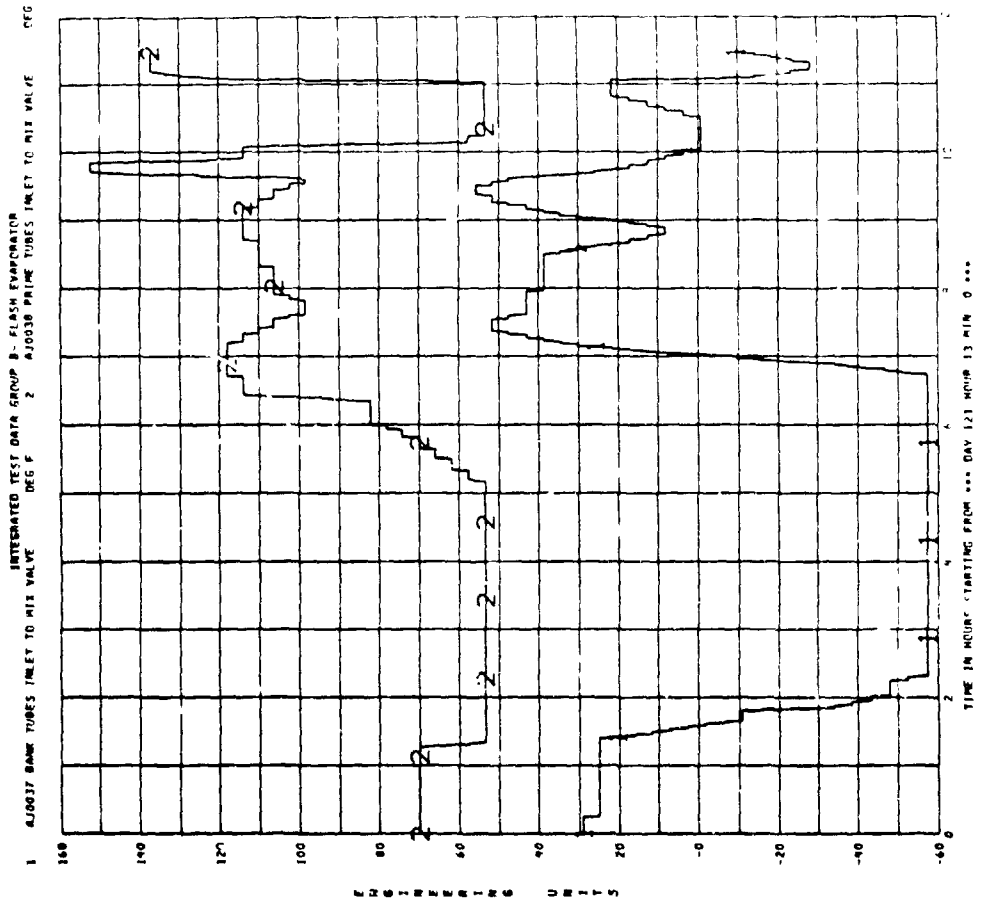
B-9



B-10

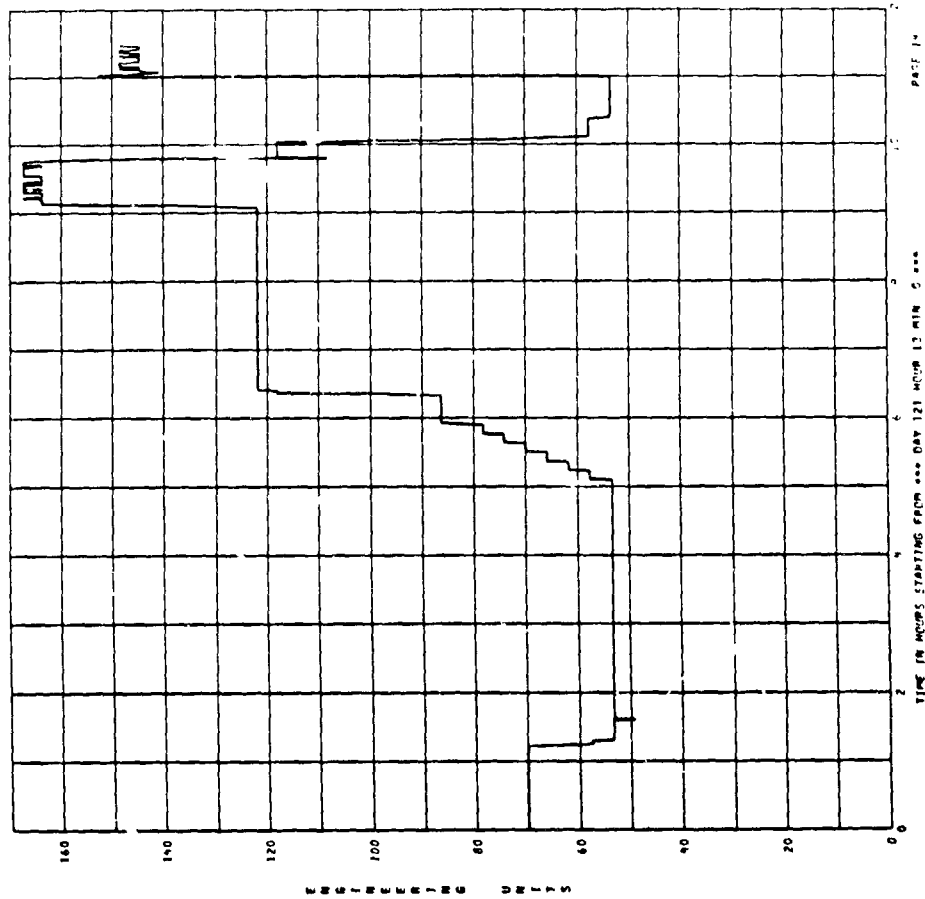


B-11



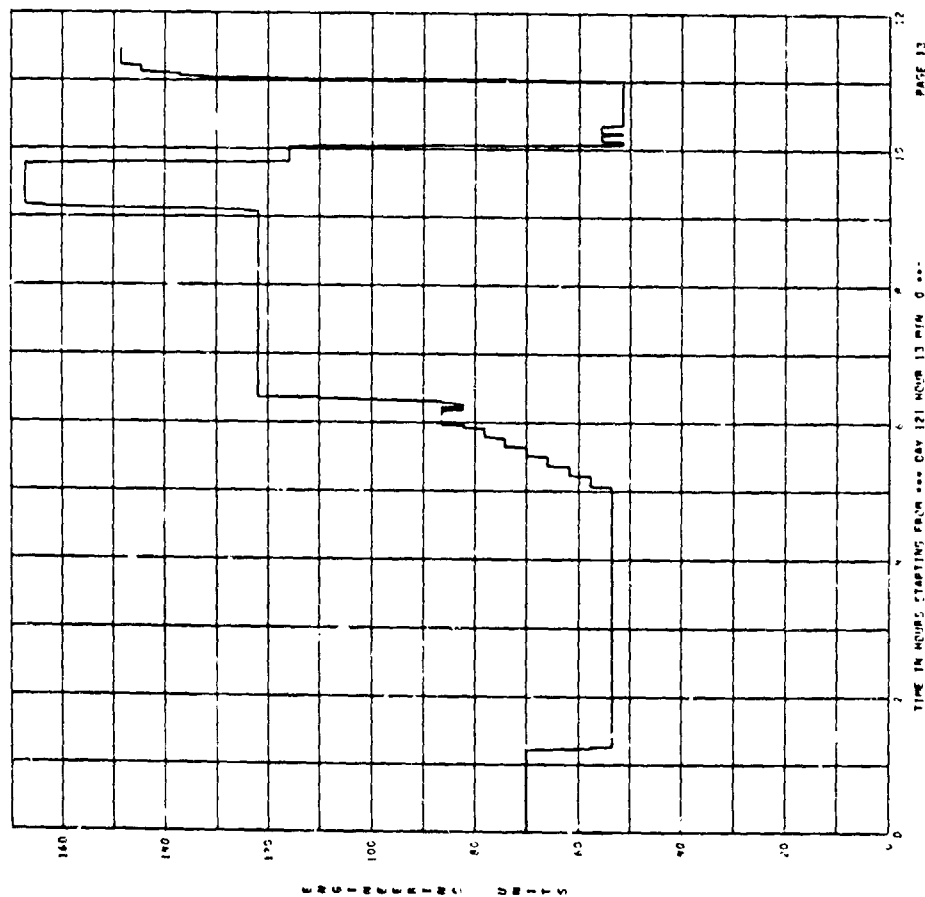
B-12

INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
 1 AJ0002 BANK SYSTEM IMET1
 DEG F

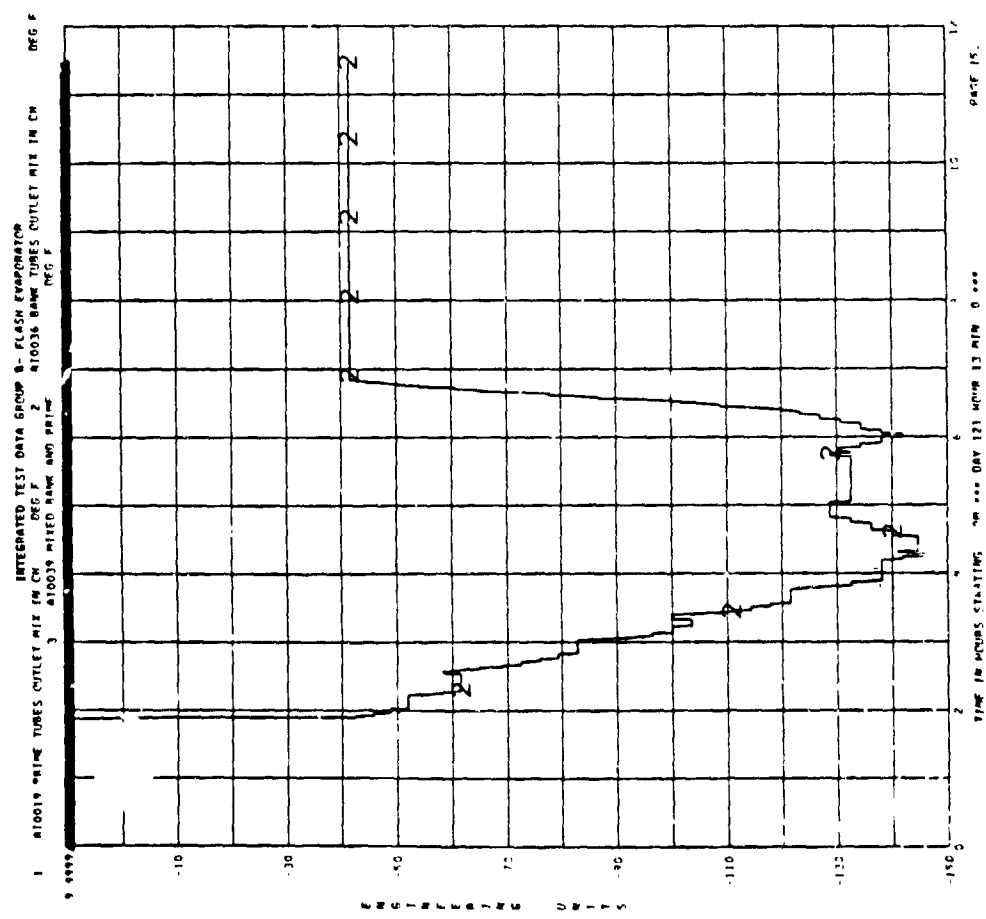


B-14

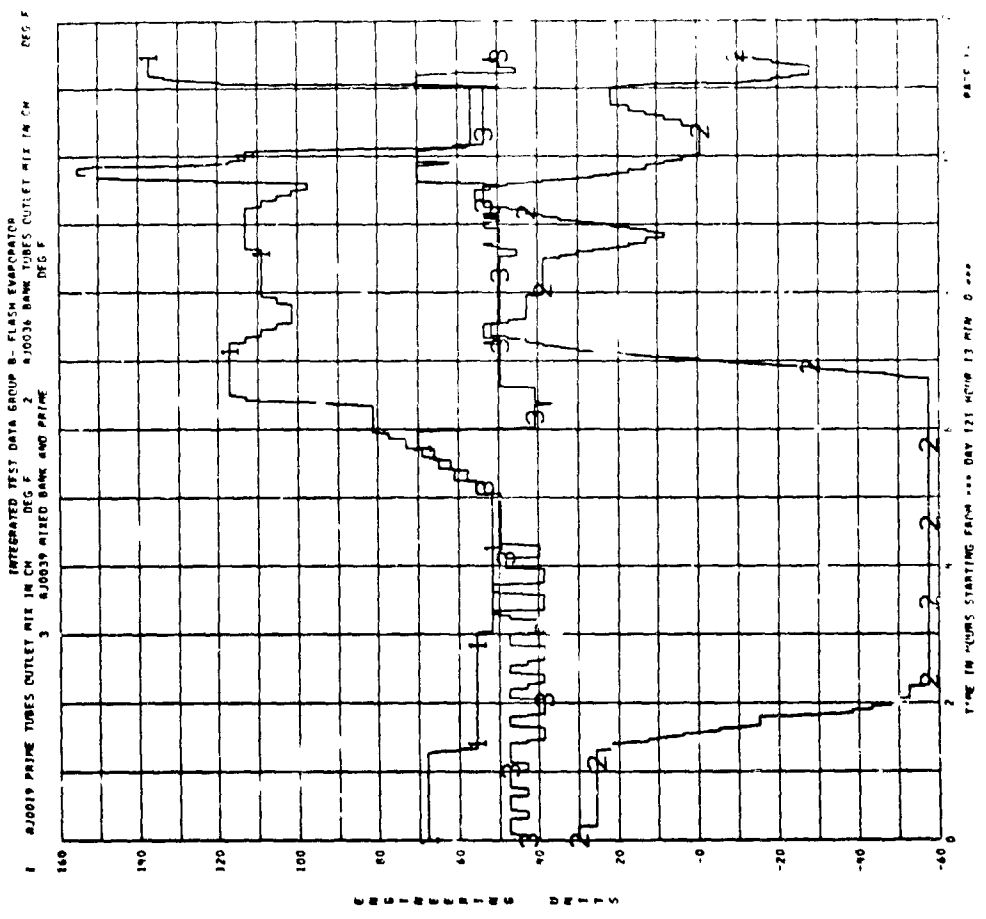
INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
 1 AJ0001 PAINE SYSTEM IMET1
 DEG F



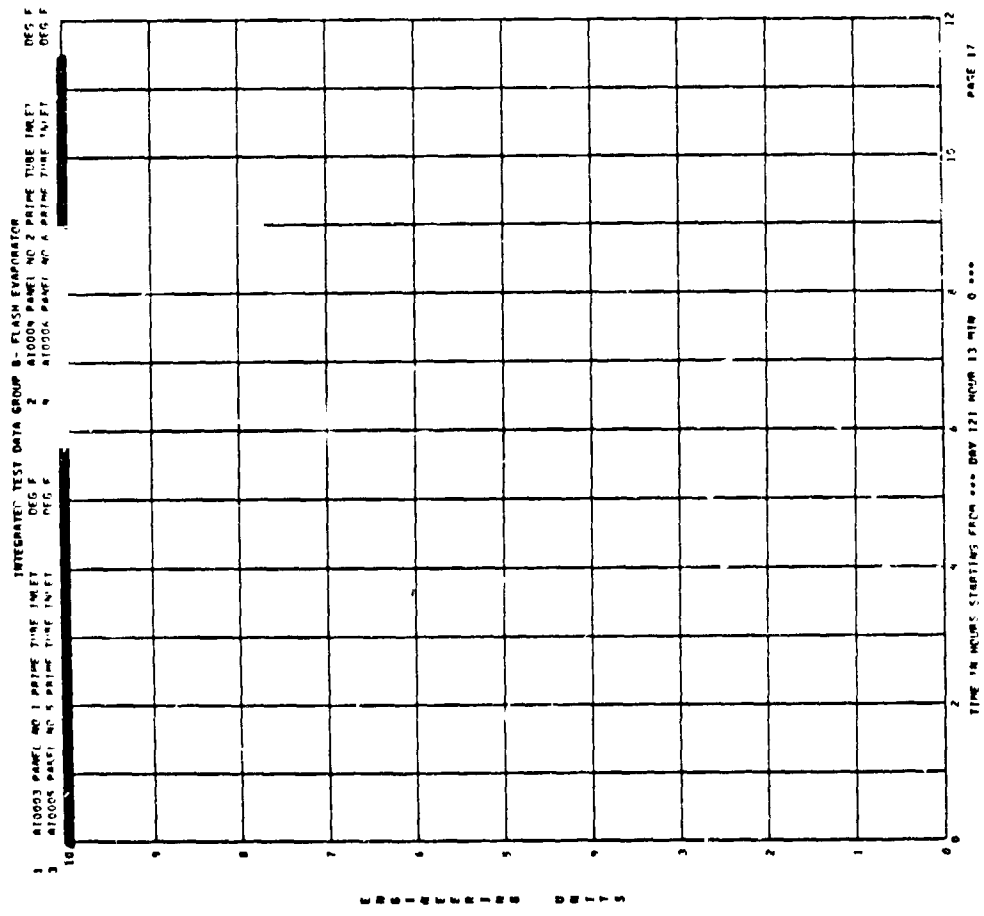
B-13



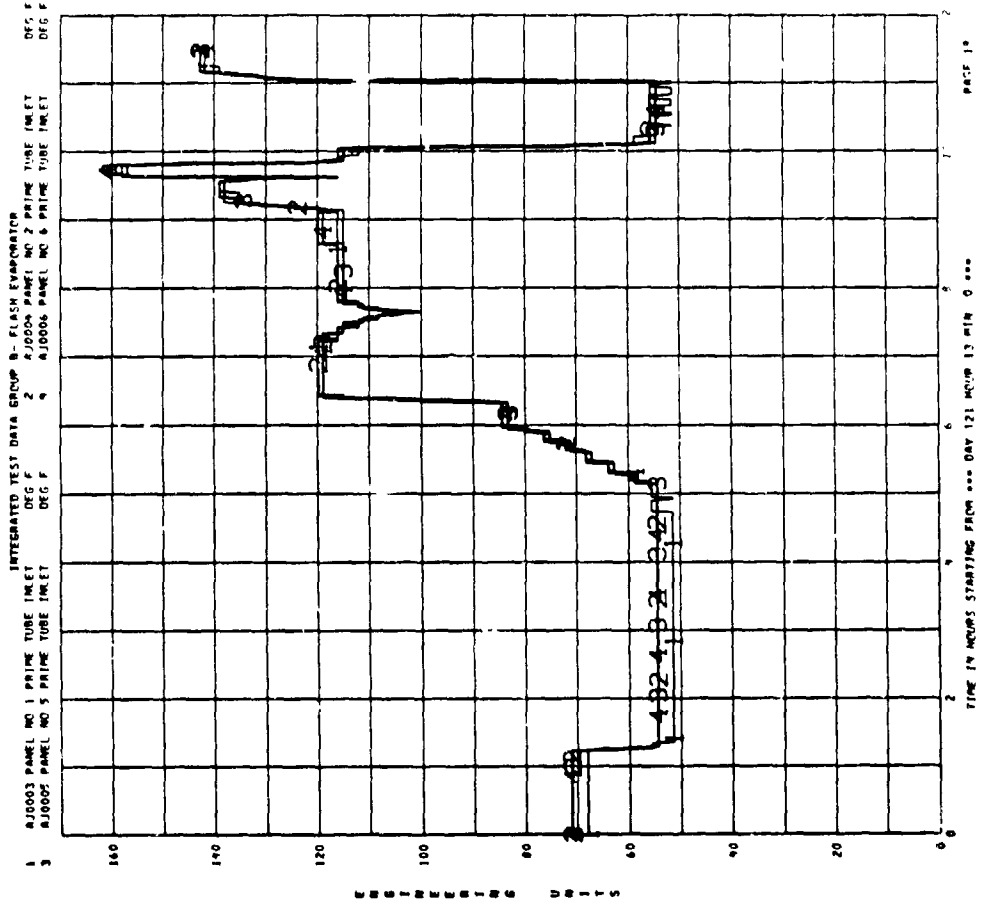
B-15



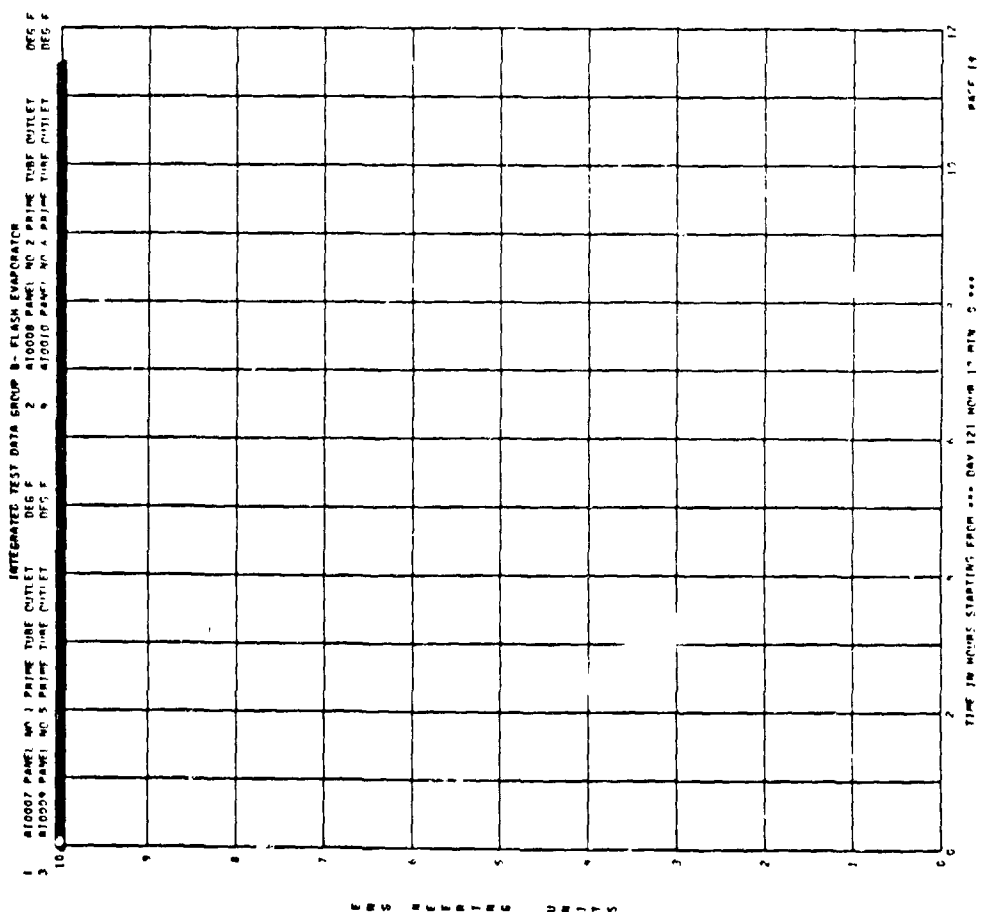
B-16



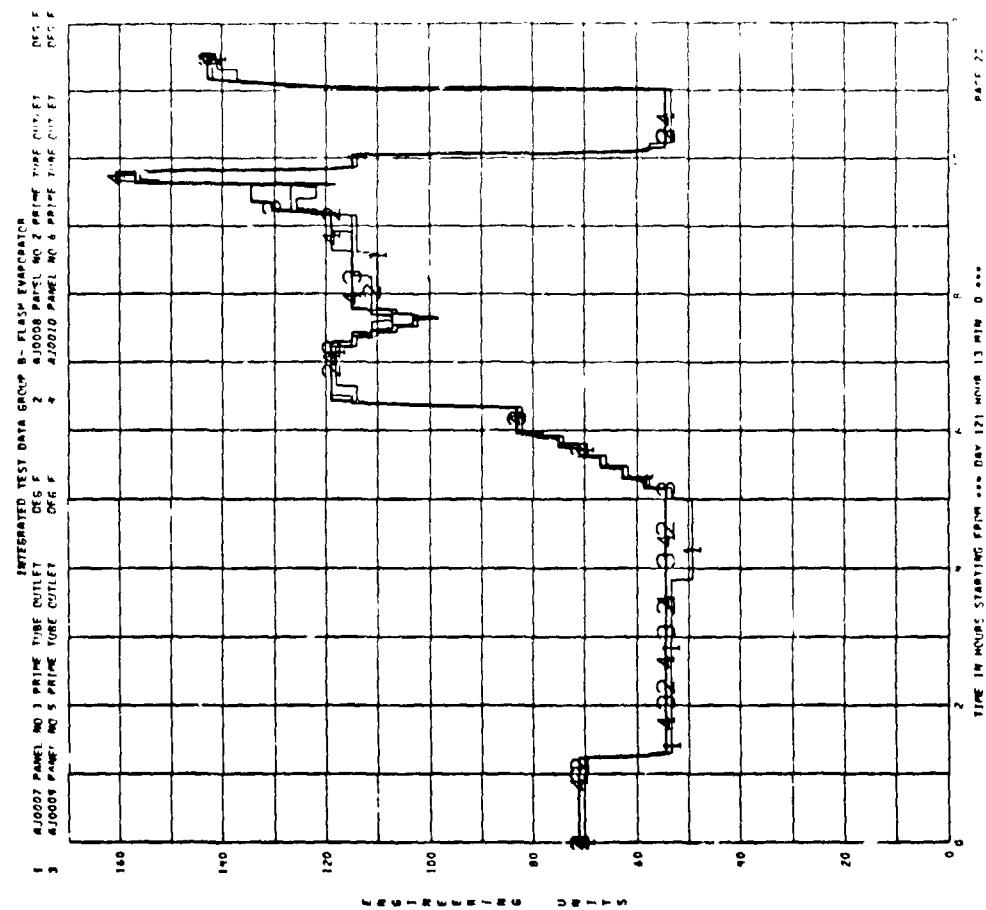
B-17



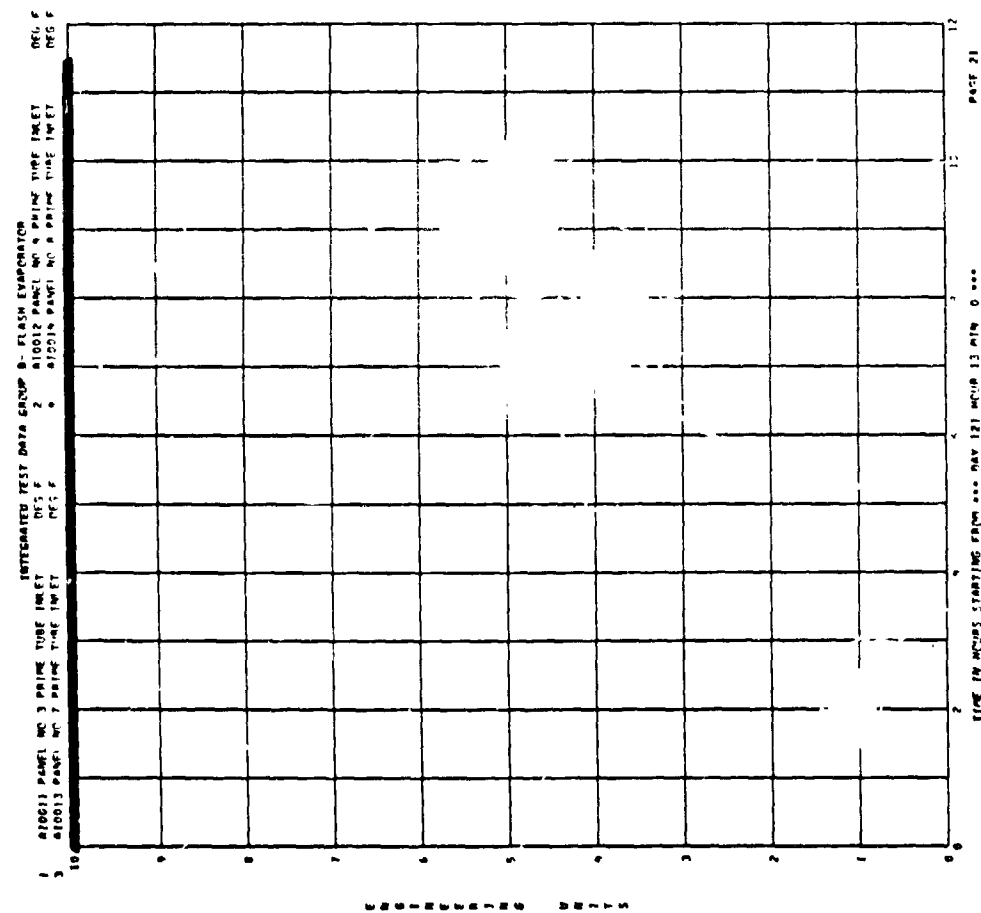
B-18



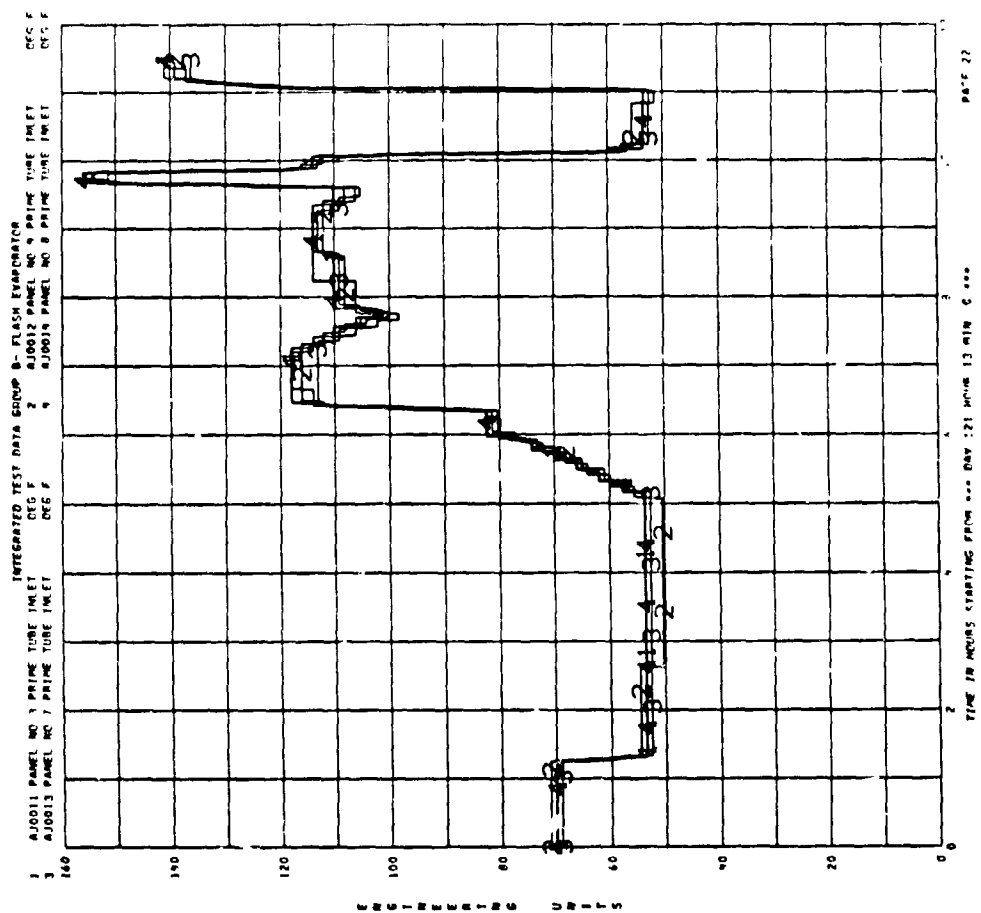
B-19



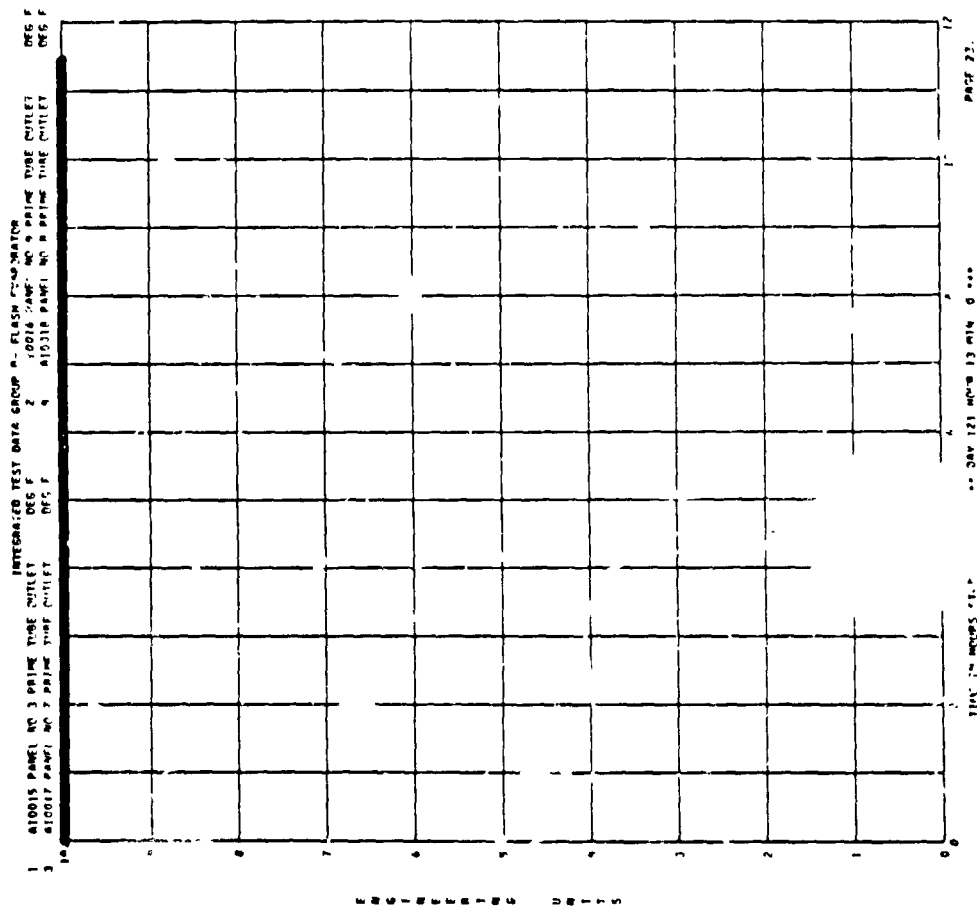
B-20



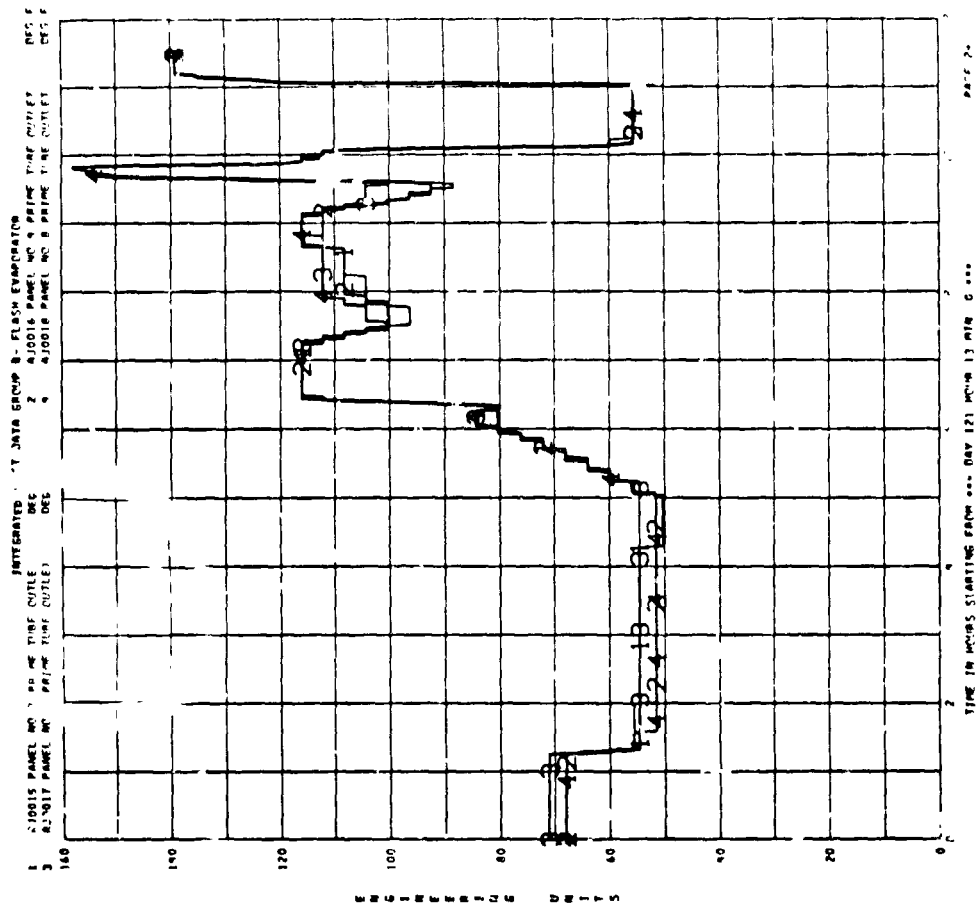
B-21



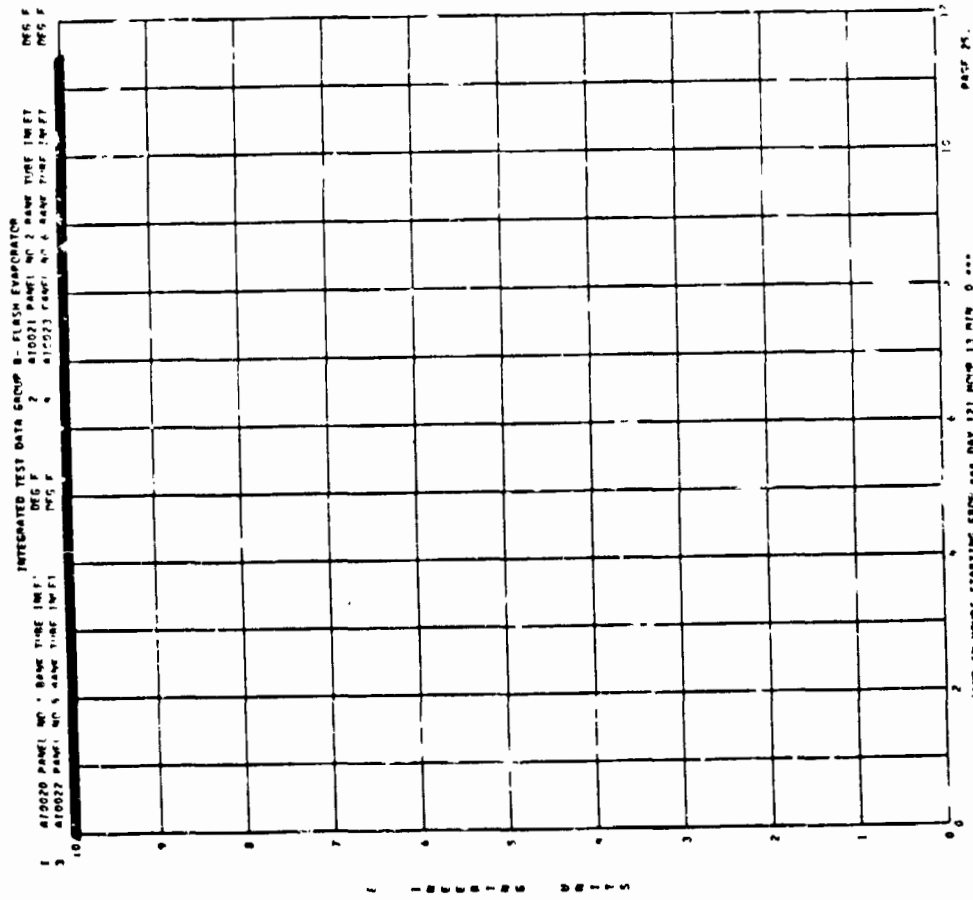
B-22



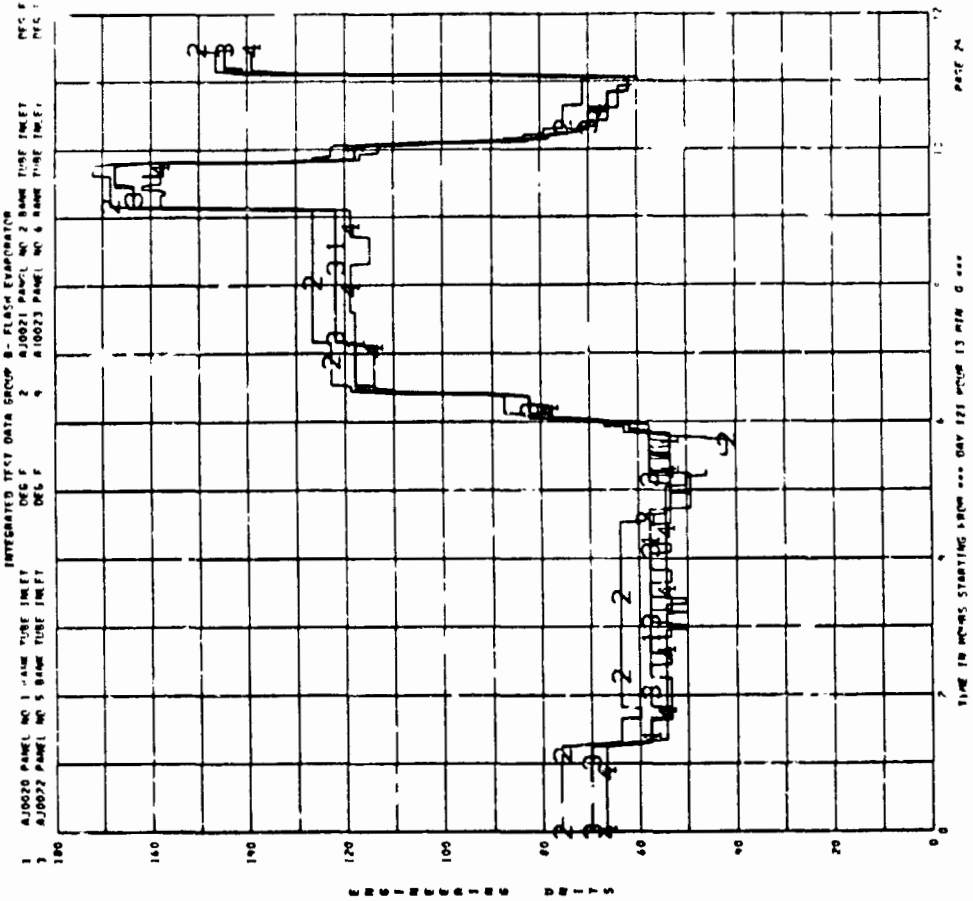
B-23



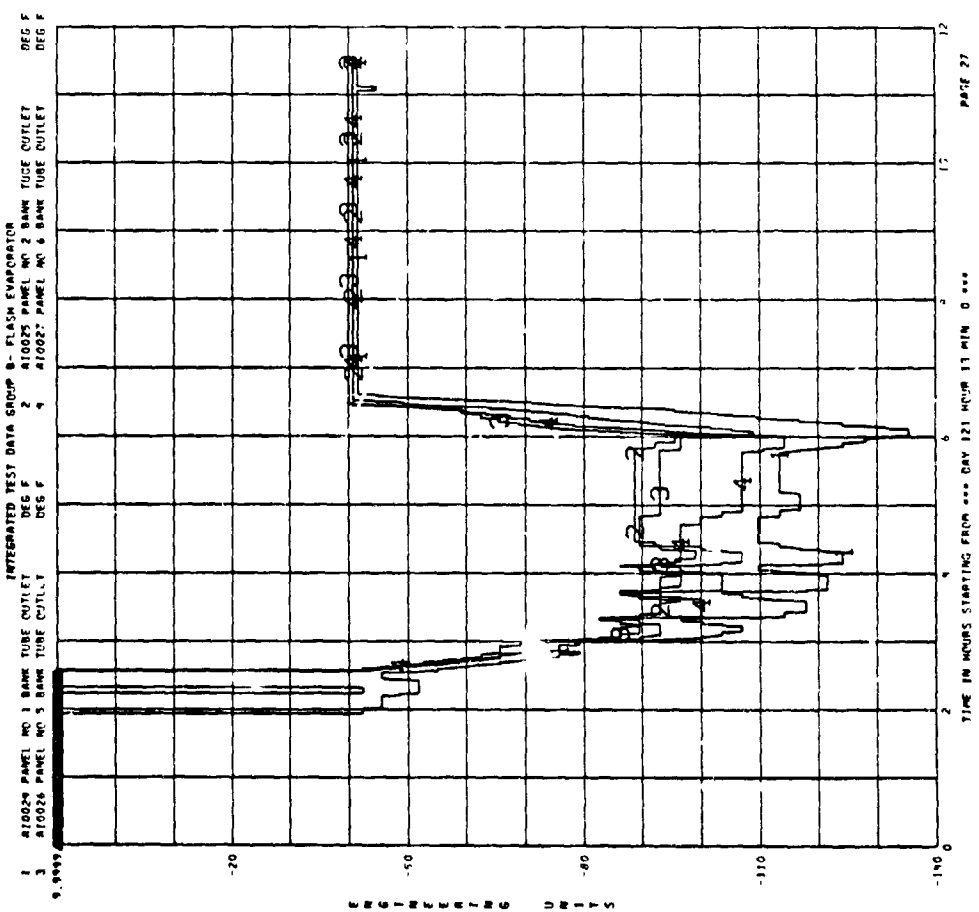
B-24



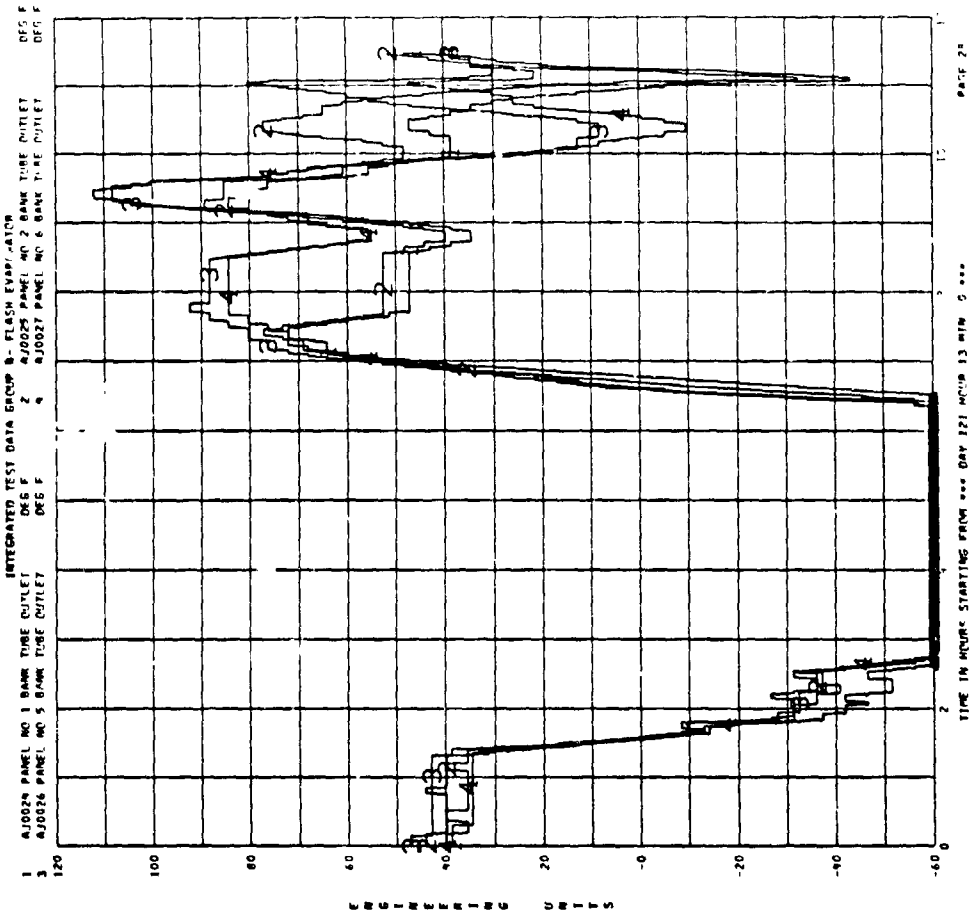
B-25



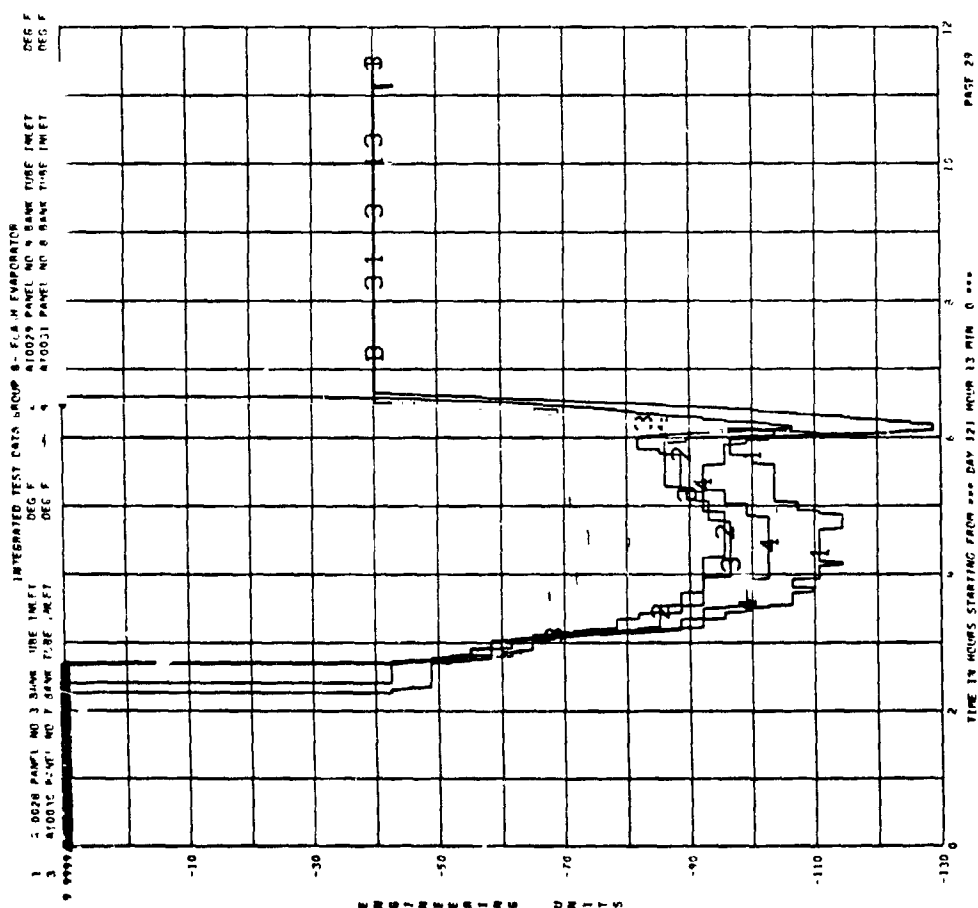
B-26



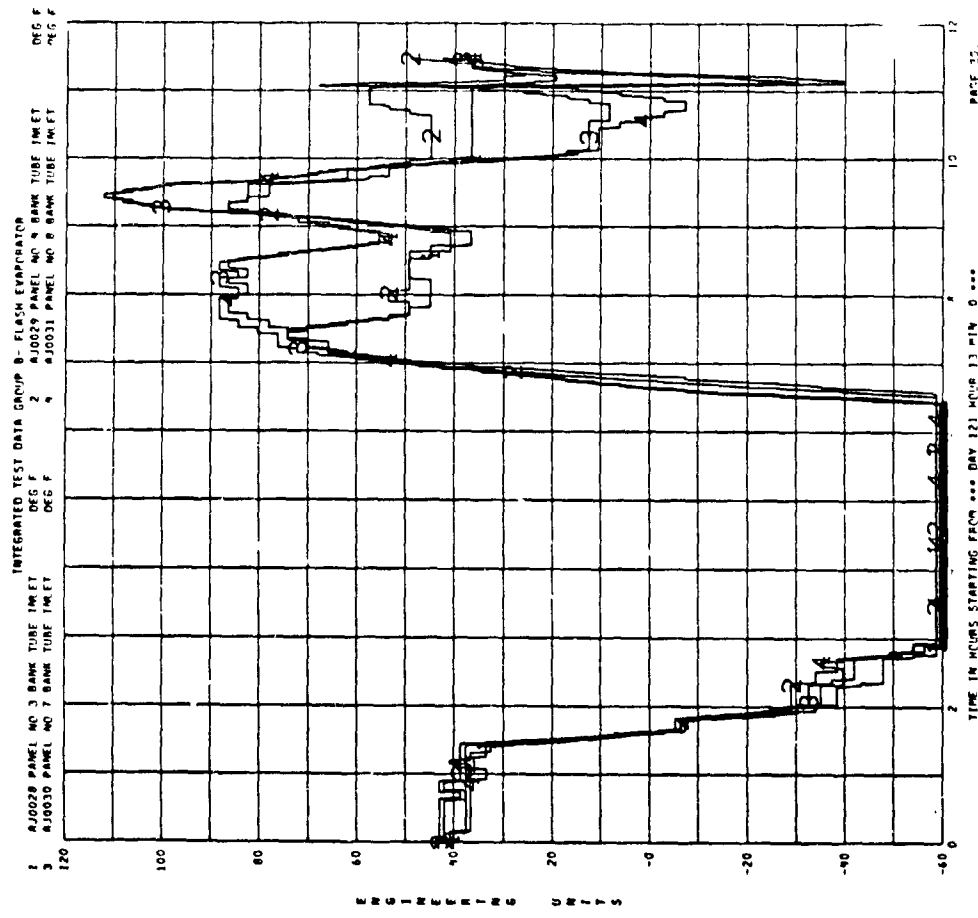
B-27



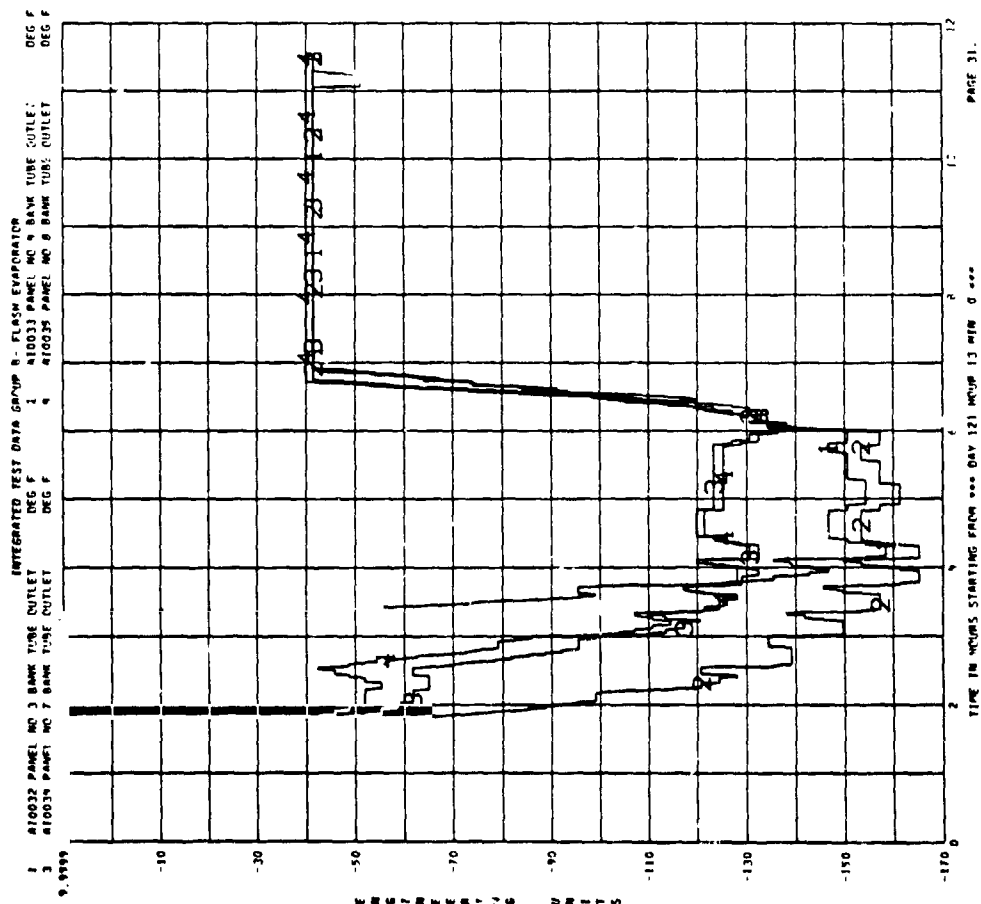
B-28



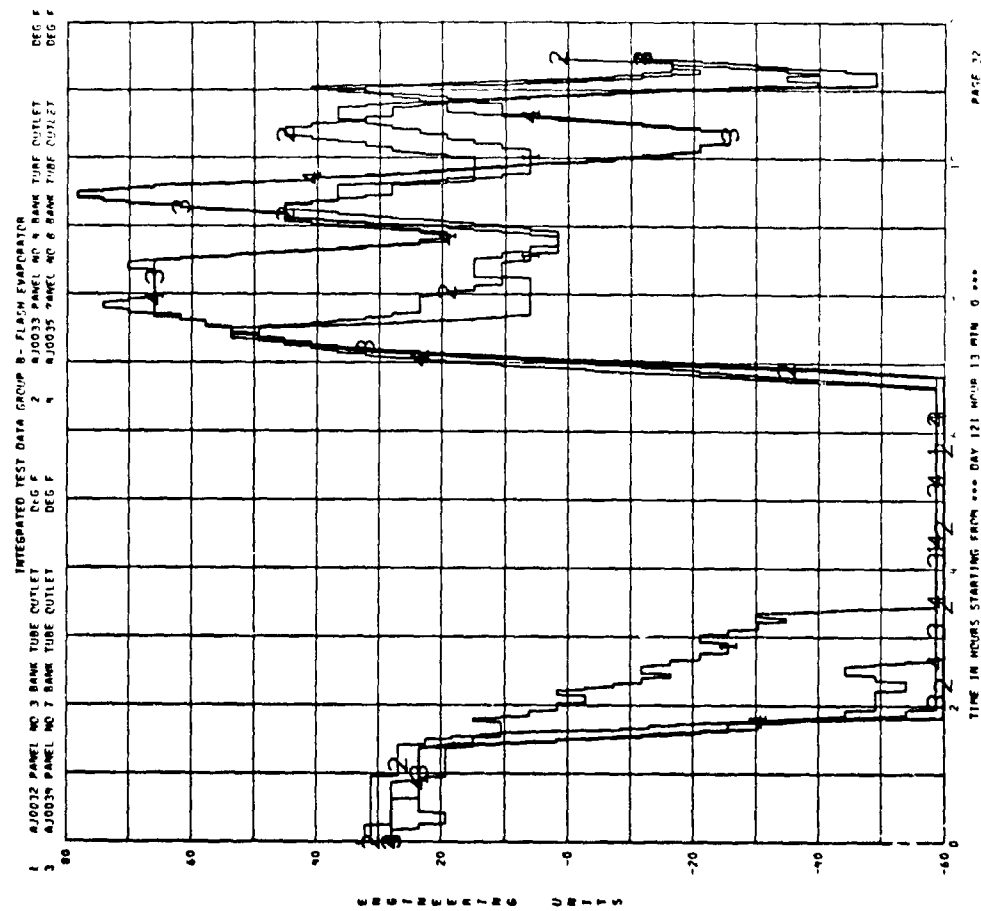
B-29



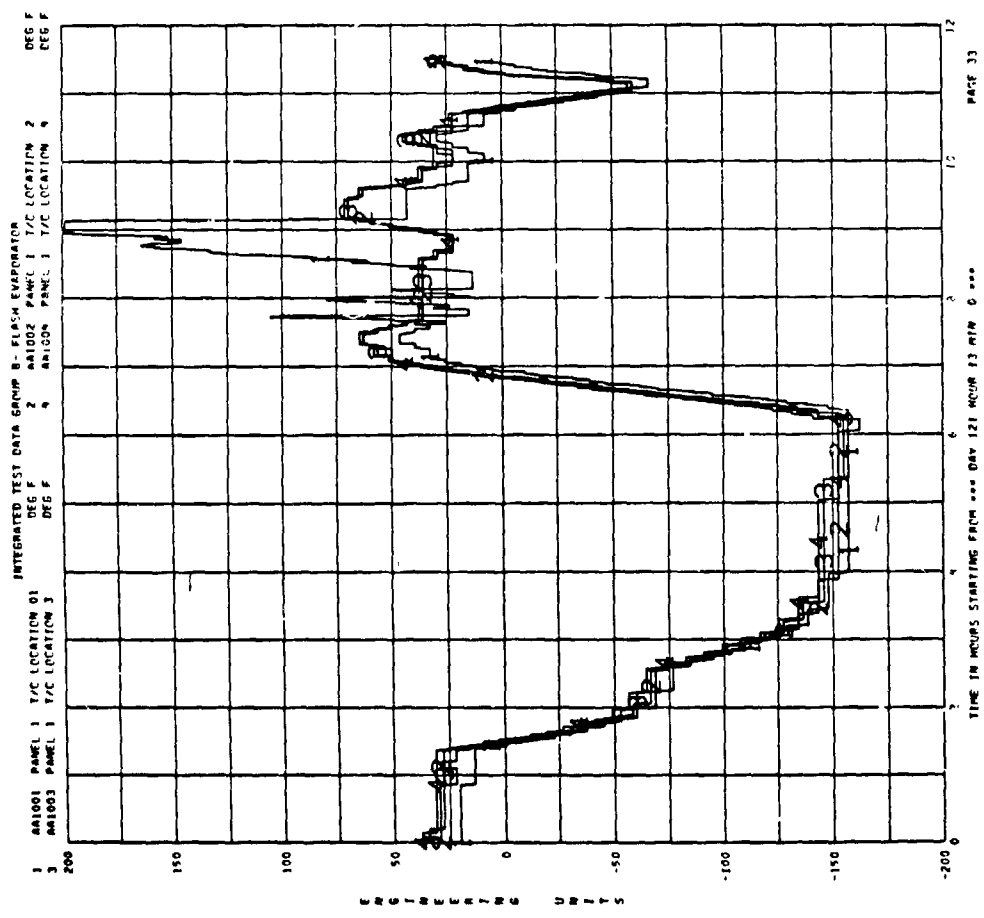
B-30



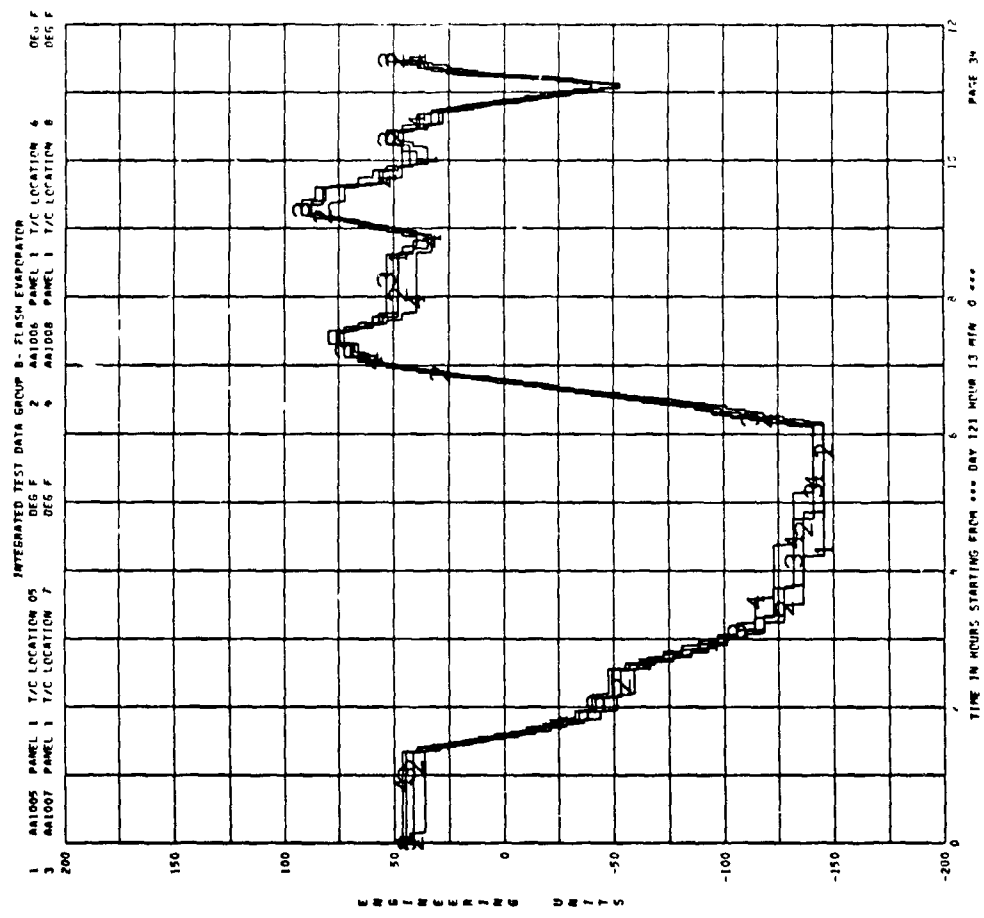
B-31



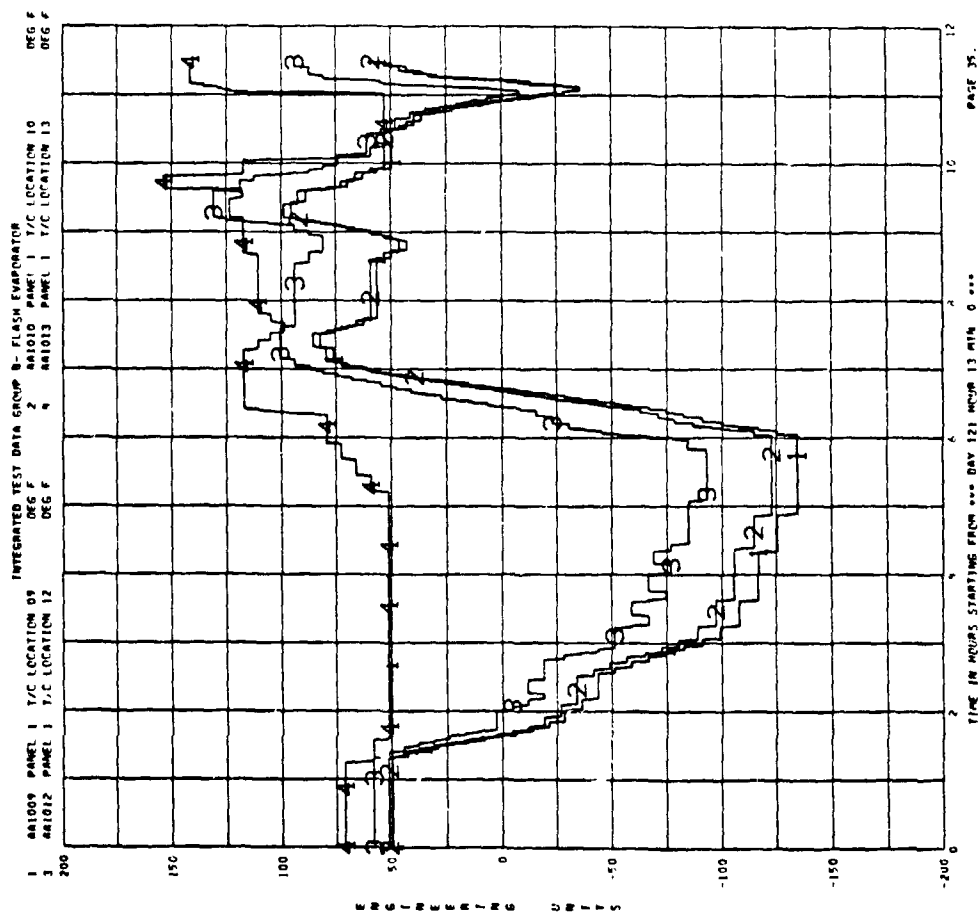
B-32



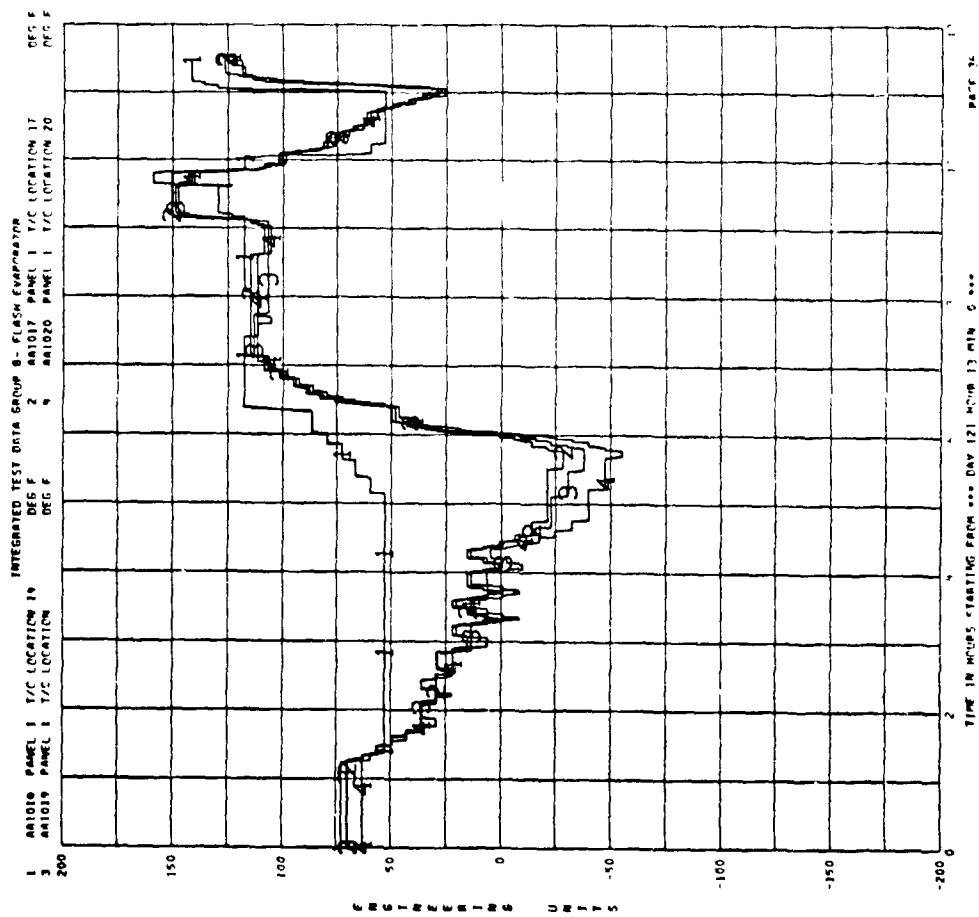
B-33



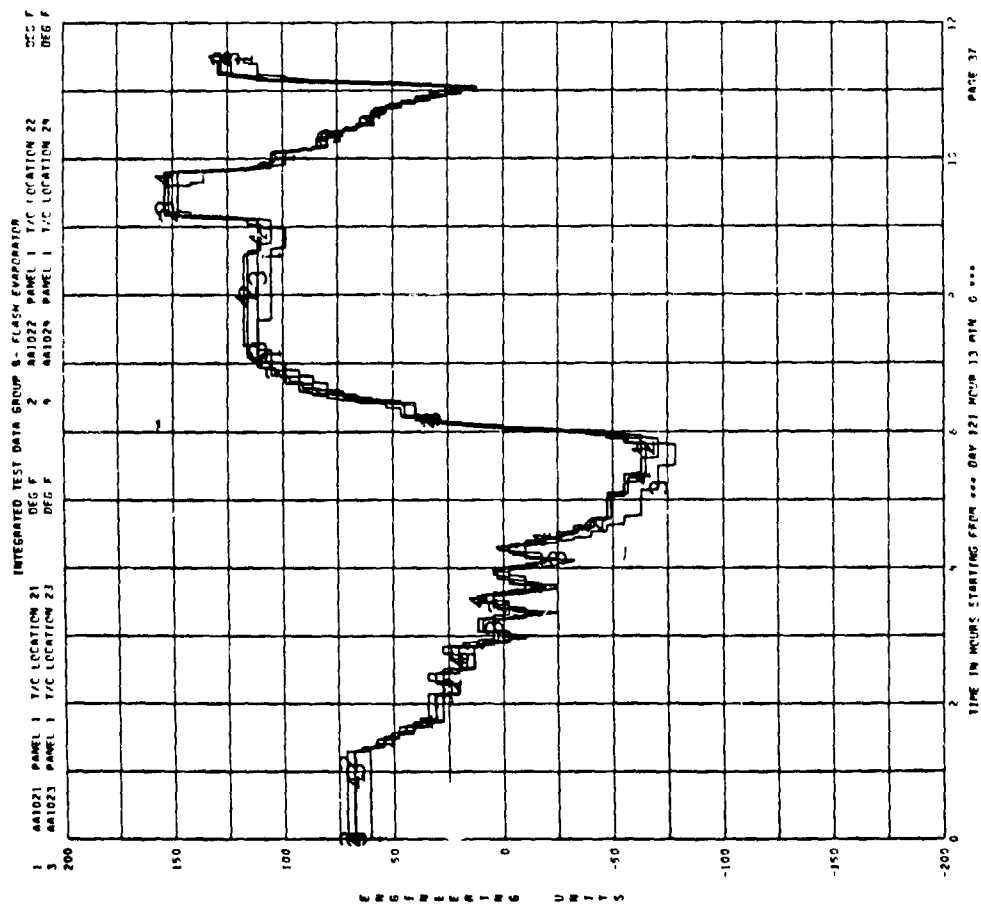
B-34



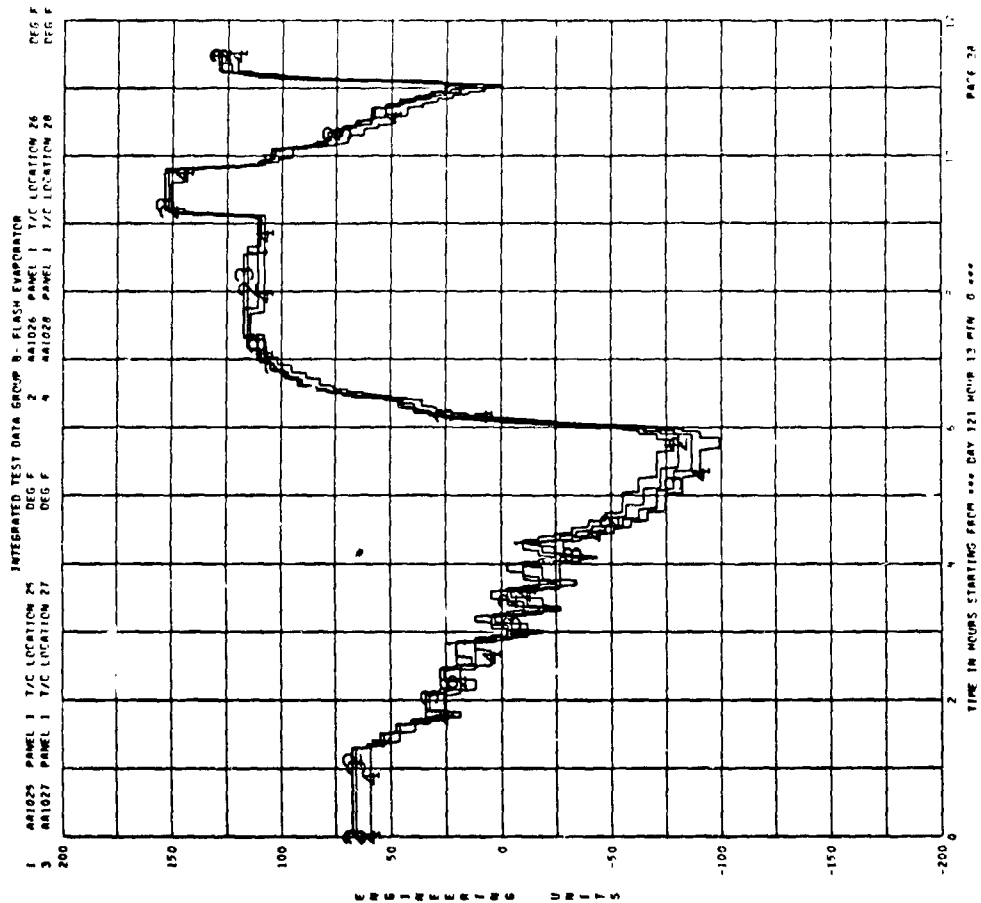
B-35



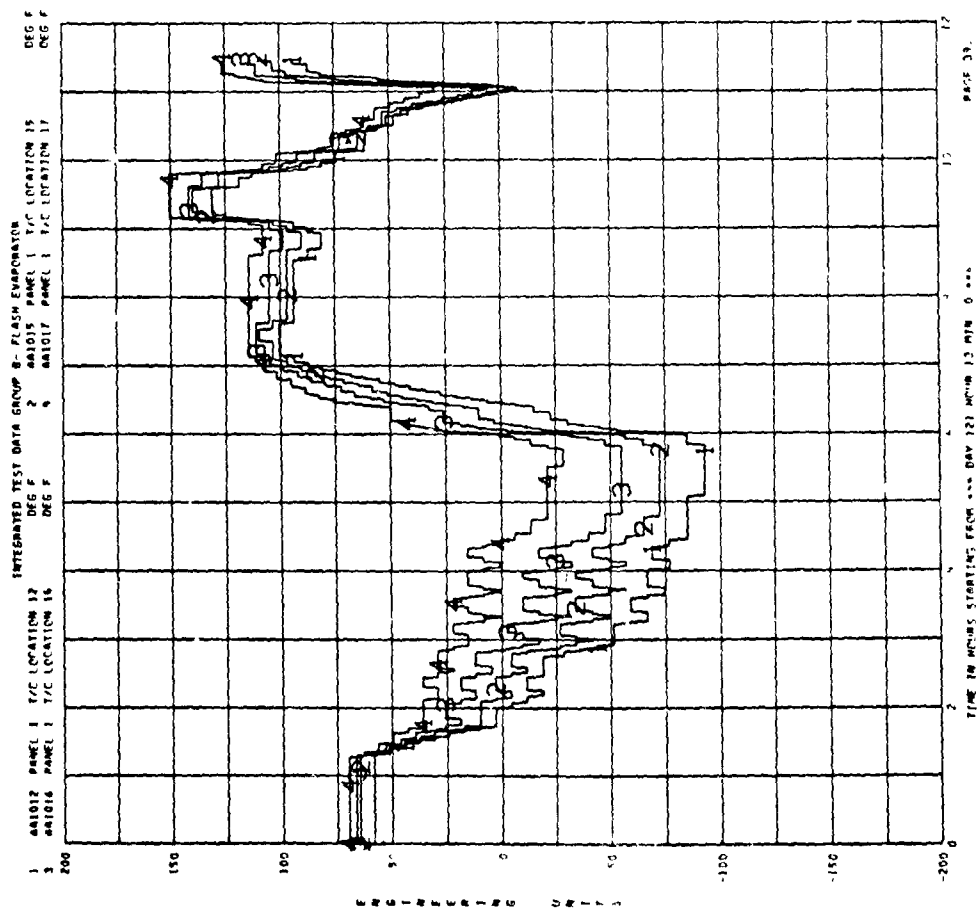
B-36



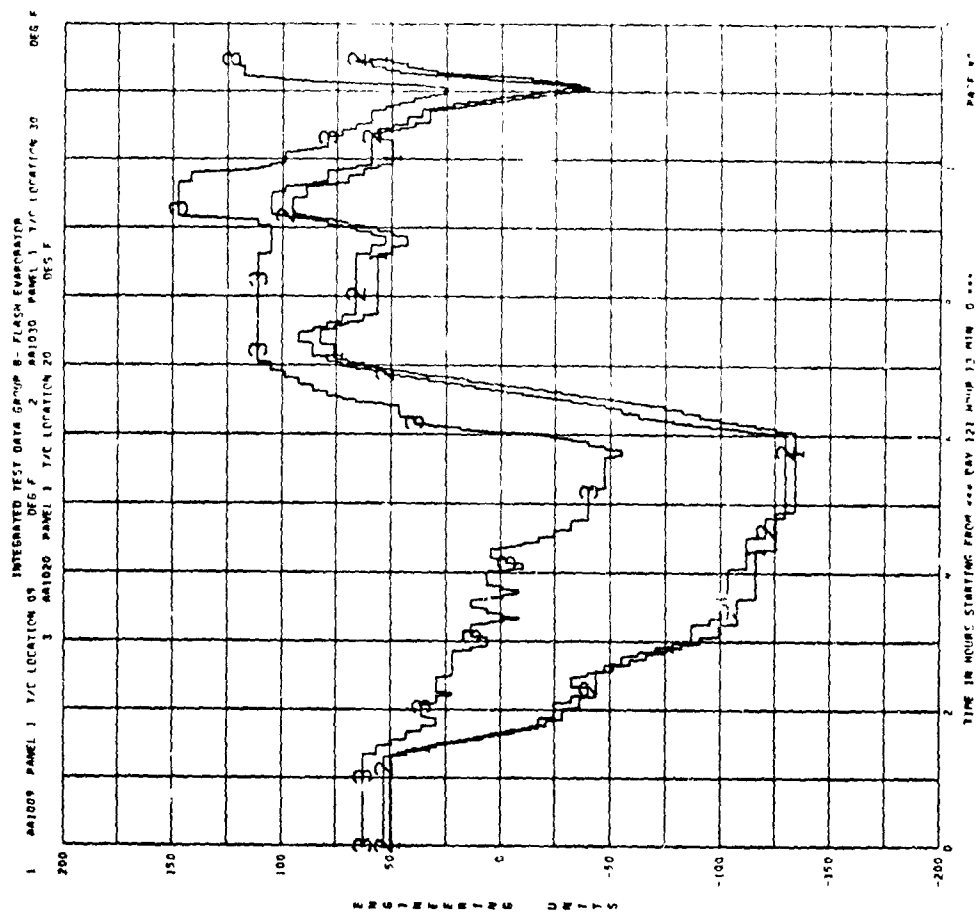
B-37



B-38

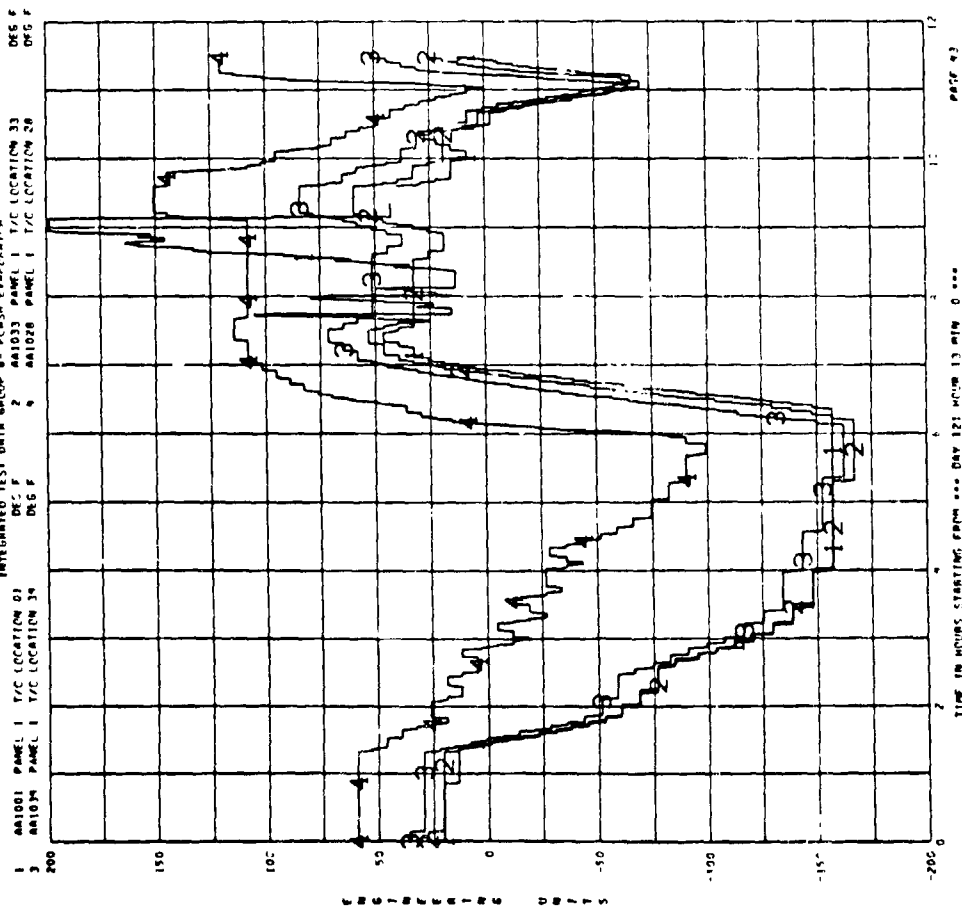


B-39



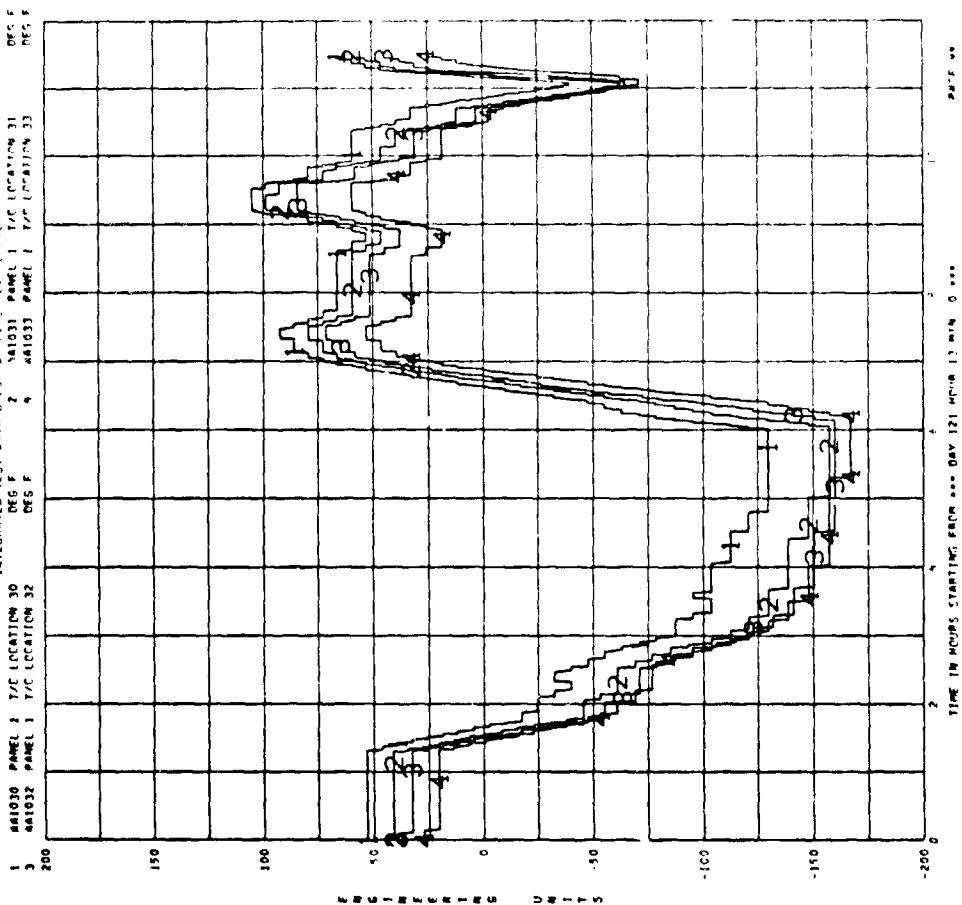
B-40

INTEGRATED TEST DATA GROUP B- FLASH EVAPORATION

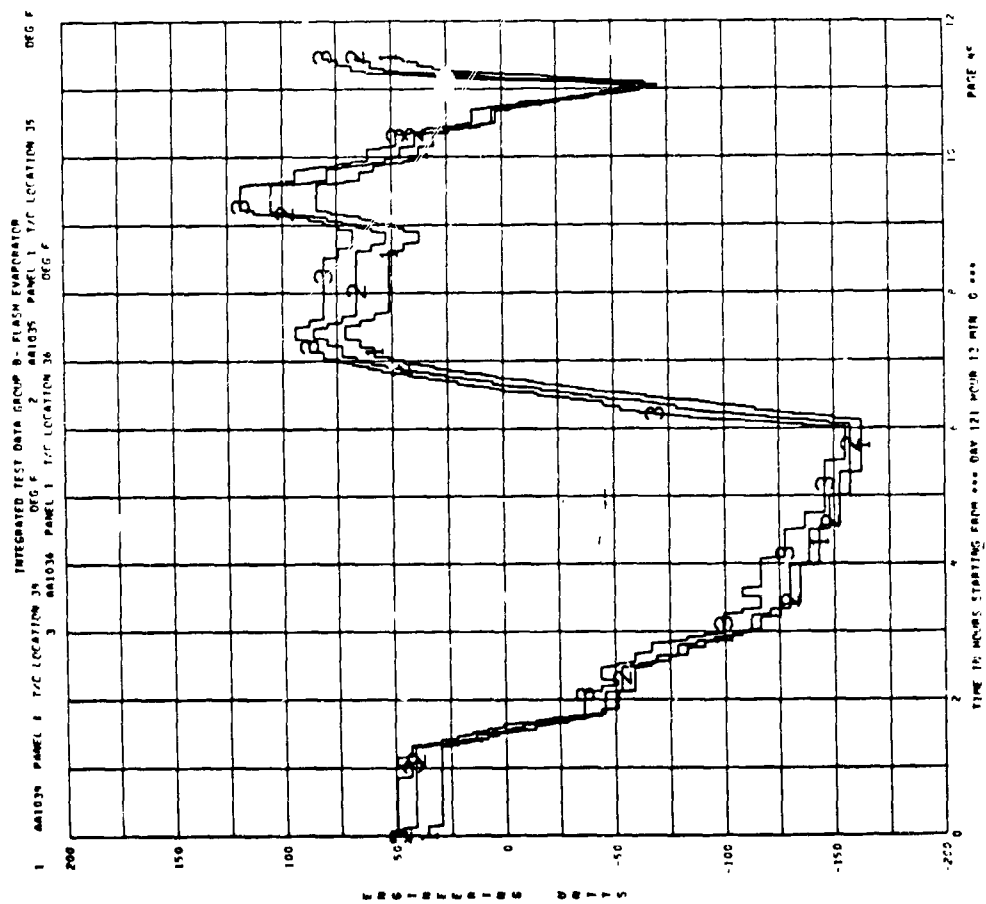


B-43

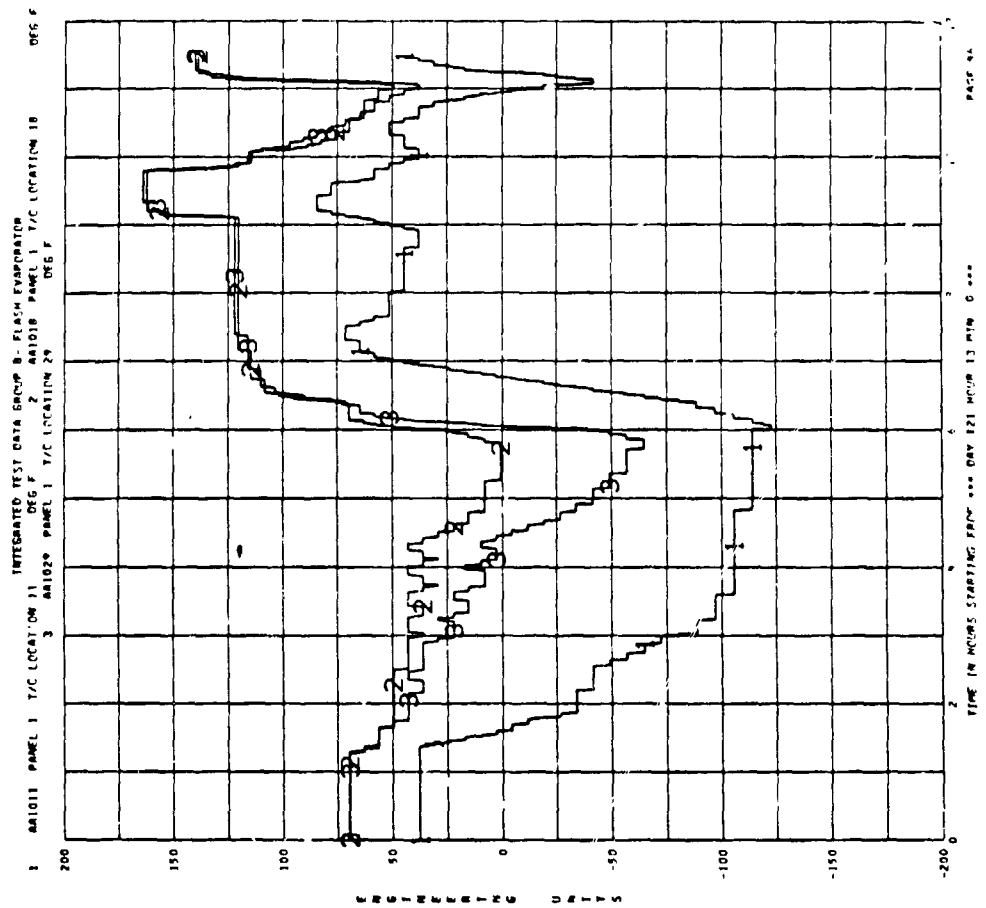
INTEGRATED TEST DATA GROUP B- FLASH EVAPORATION



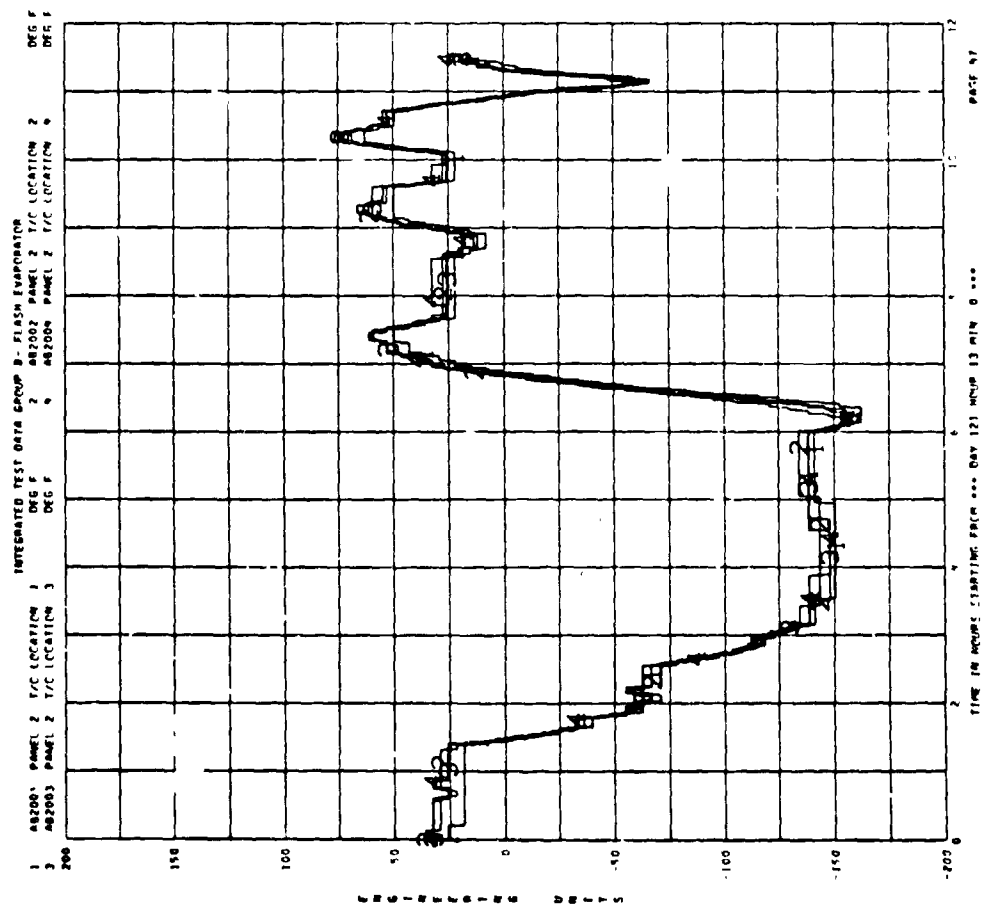
B-44



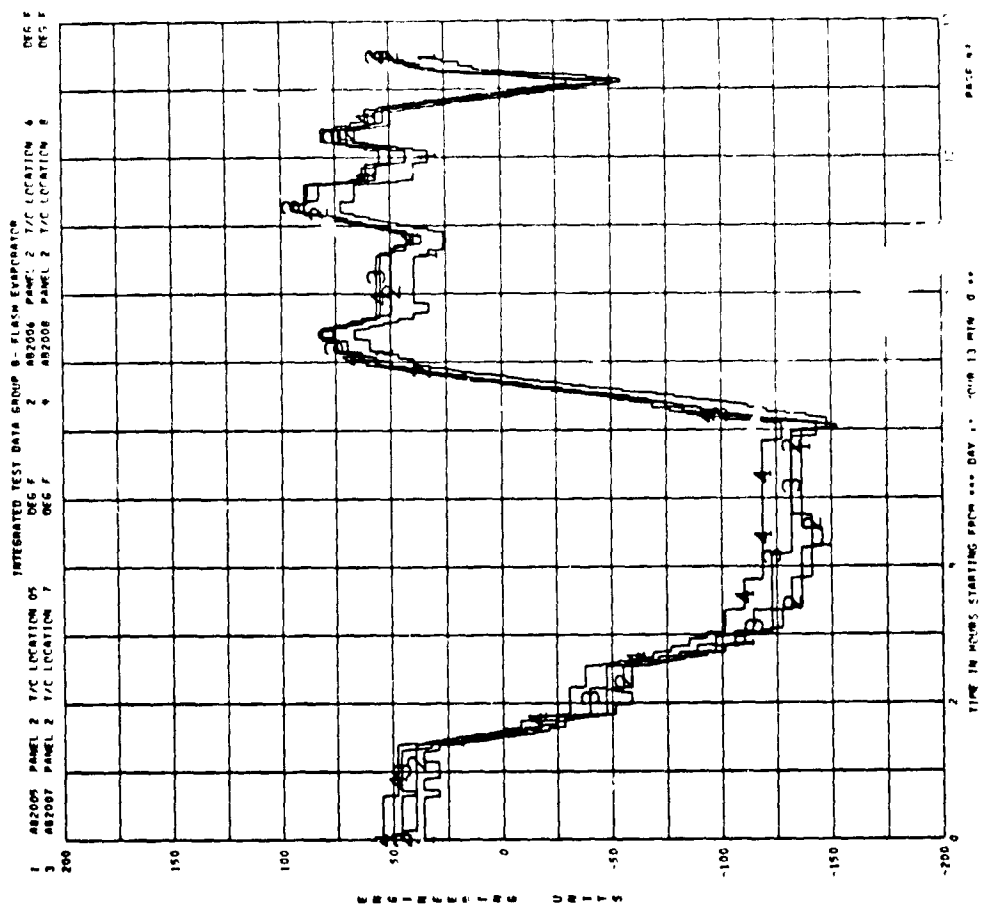
B-45



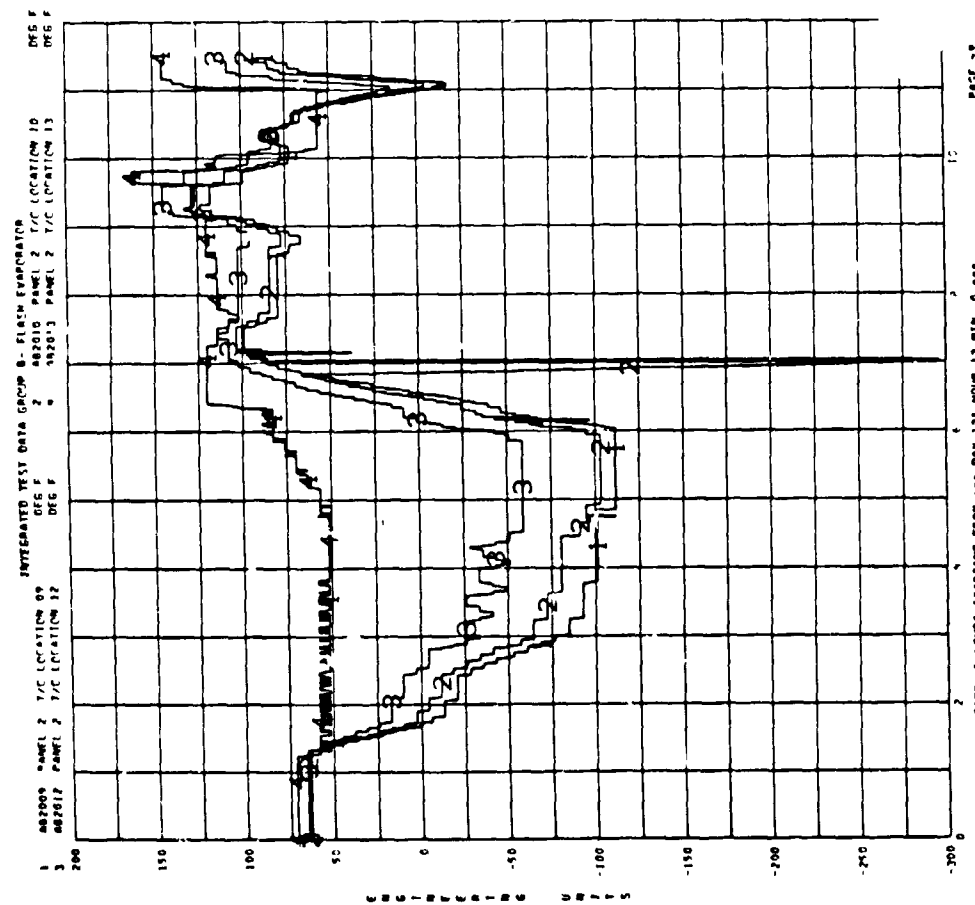
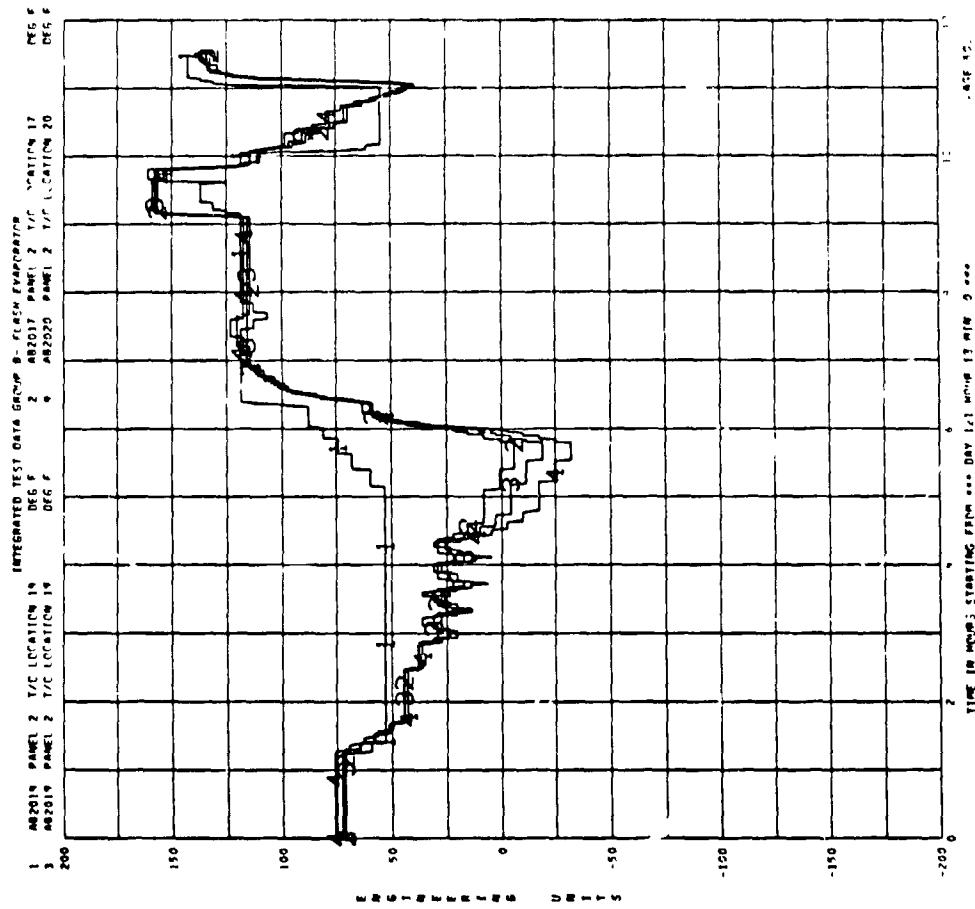
B-46

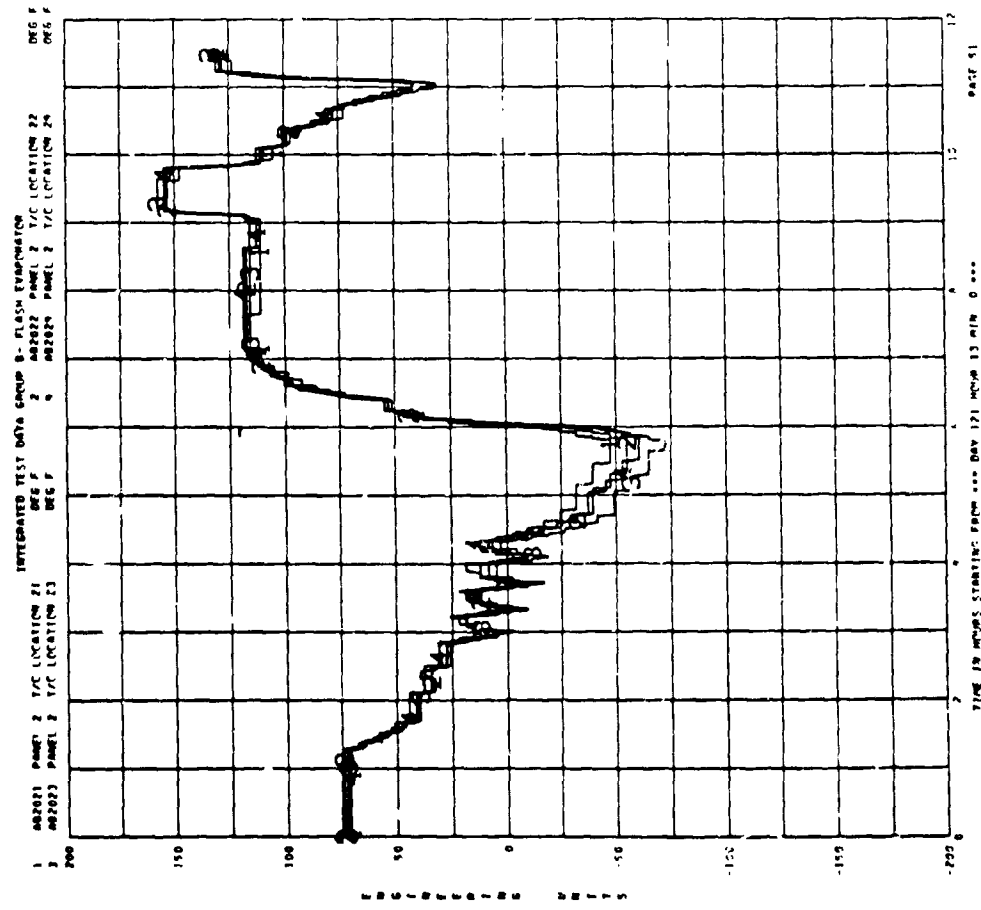


B-47

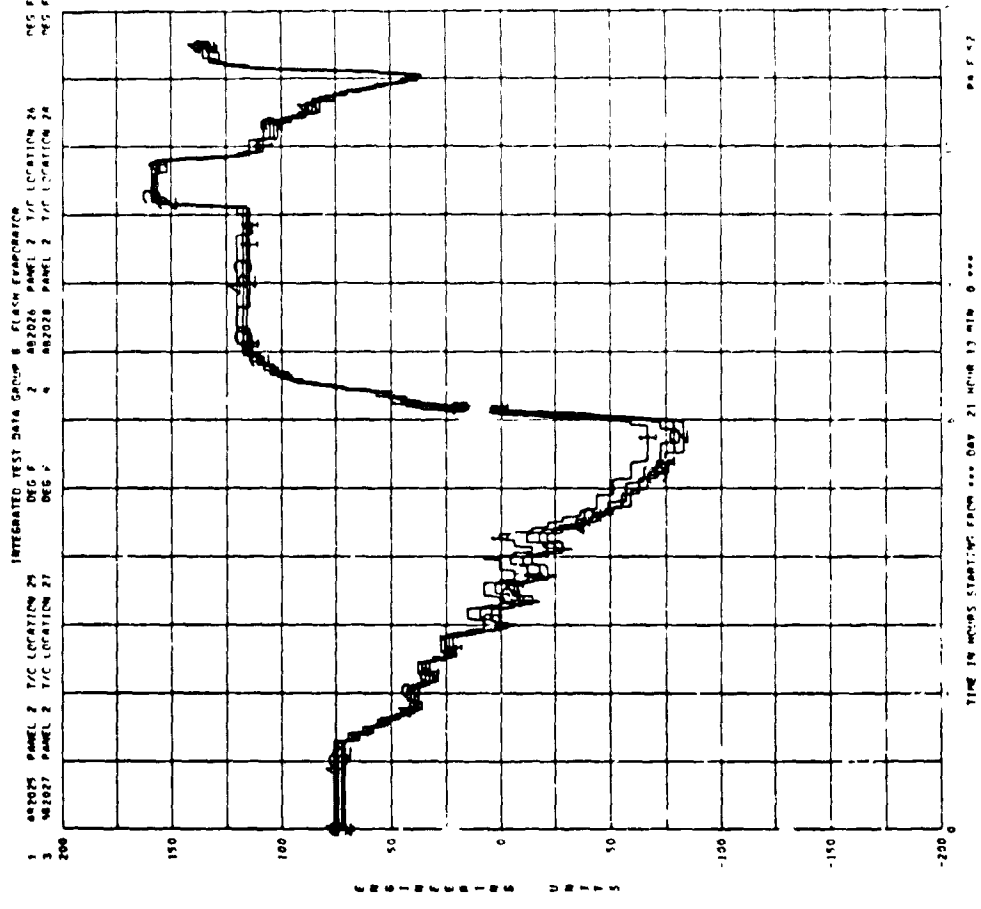


B-48



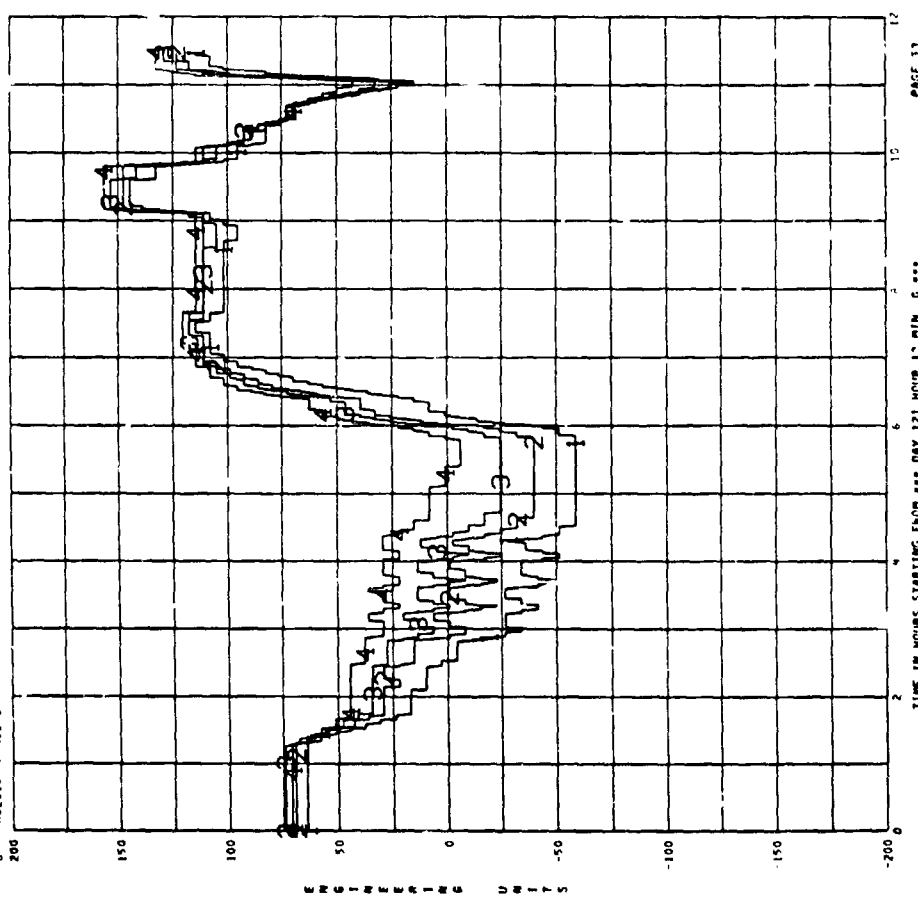


B-51



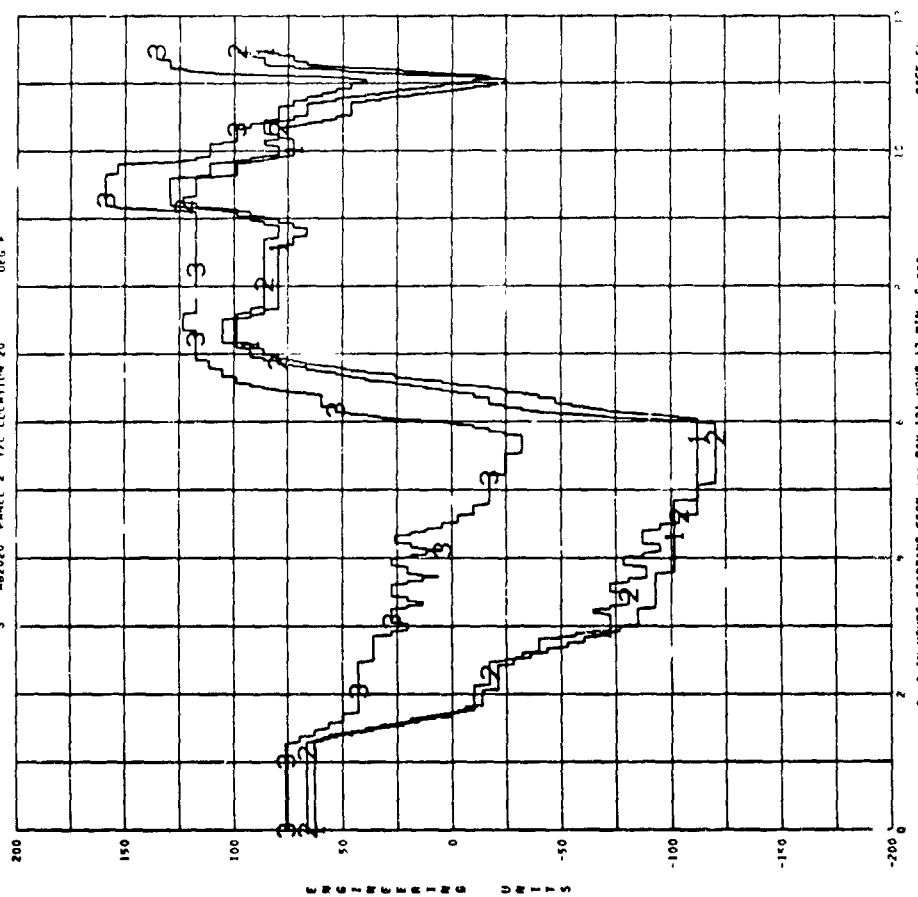
B-52

| INTEGRATED TEST DATA GROUP 8 - FLAMM EVAPORATOR | | | |
|---|--------|---------|-----------------|
| | | DEG F | |
| 1 | AB2012 | PANEL 2 | T/C LOCATION 12 |
| 2 | AB2015 | PANEL 2 | T/C LOCATION 15 |
| 3 | AB2016 | PANEL 2 | T/C LOCATION 16 |
| 4 | AB2017 | PANEL 2 | T/C LOCATION 1 |
| 5 | AB2018 | PANEL 2 | T/C LOCATION 1 |
| 6 | AB2019 | PANEL 2 | T/C LOCATION 1 |
| 7 | AB2020 | PANEL 2 | T/C LOCATION 1 |
| 8 | AB2021 | PANEL 2 | T/C LOCATION 1 |
| 9 | AB2022 | PANEL 2 | T/C LOCATION 1 |
| 10 | AB2023 | PANEL 2 | T/C LOCATION 1 |
| 11 | AB2024 | PANEL 2 | T/C LOCATION 1 |
| 12 | AB2025 | PANEL 2 | T/C LOCATION 1 |
| 13 | AB2026 | PANEL 2 | T/C LOCATION 1 |
| 14 | AB2027 | PANEL 2 | T/C LOCATION 1 |
| 15 | AB2028 | PANEL 2 | T/C LOCATION 1 |
| 16 | AB2029 | PANEL 2 | T/C LOCATION 1 |
| 17 | AB2030 | PANEL 2 | T/C LOCATION 1 |
| 18 | AB2031 | PANEL 2 | T/C LOCATION 1 |
| 19 | AB2032 | PANEL 2 | T/C LOCATION 1 |
| 20 | AB2033 | PANEL 2 | T/C LOCATION 1 |
| 21 | AB2034 | PANEL 2 | T/C LOCATION 1 |
| 22 | AB2035 | PANEL 2 | T/C LOCATION 1 |
| 23 | AB2036 | PANEL 2 | T/C LOCATION 1 |
| 24 | AB2037 | PANEL 2 | T/C LOCATION 1 |
| 25 | AB2038 | PANEL 2 | T/C LOCATION 1 |
| 26 | AB2039 | PANEL 2 | T/C LOCATION 1 |
| 27 | AB2040 | PANEL 2 | T/C LOCATION 1 |
| 28 | AB2041 | PANEL 2 | T/C LOCATION 1 |
| 29 | AB2042 | PANEL 2 | T/C LOCATION 1 |
| 30 | AB2043 | PANEL 2 | T/C LOCATION 1 |
| 31 | AB2044 | PANEL 2 | T/C LOCATION 1 |
| 32 | AB2045 | PANEL 2 | T/C LOCATION 1 |
| 33 | AB2046 | PANEL 2 | T/C LOCATION 1 |
| 34 | AB2047 | PANEL 2 | T/C LOCATION 1 |
| 35 | AB2048 | PANEL 2 | T/C LOCATION 1 |
| 36 | AB2049 | PANEL 2 | T/C LOCATION 1 |
| 37 | AB2050 | PANEL 2 | T/C LOCATION 1 |
| 38 | AB2051 | PANEL 2 | T/C LOCATION 1 |
| 39 | AB2052 | PANEL 2 | T/C LOCATION 1 |
| 40 | AB2053 | PANEL 2 | T/C LOCATION 1 |
| 41 | AB2054 | PANEL 2 | T/C LOCATION 1 |
| 42 | AB2055 | PANEL 2 | T/C LOCATION 1 |
| 43 | AB2056 | PANEL 2 | T/C LOCATION 1 |
| 44 | AB2057 | PANEL 2 | T/C LOCATION 1 |
| 45 | AB2058 | PANEL 2 | T/C LOCATION 1 |
| 46 | AB2059 | PANEL 2 | T/C LOCATION 1 |
| 47 | AB2060 | PANEL 2 | T/C LOCATION 1 |
| 48 | AB2061 | PANEL 2 | T/C LOCATION 1 |
| 49 | AB2062 | PANEL 2 | T/C LOCATION 1 |
| 50 | AB2063 | PANEL 2 | T/C LOCATION 1 |
| 51 | AB2064 | PANEL 2 | T/C LOCATION 1 |
| 52 | AB2065 | PANEL 2 | T/C LOCATION 1 |
| 53 | AB2066 | PANEL 2 | T/C LOCATION 1 |
| 54 | AB2067 | PANEL 2 | T/C LOCATION 1 |
| 55 | AB2068 | PANEL 2 | T/C LOCATION 1 |
| 56 | AB2069 | PANEL 2 | T/C LOCATION 1 |
| 57 | AB2070 | PANEL 2 | T/C LOCATION 1 |
| 58 | AB2071 | PANEL 2 | T/C LOCATION 1 |
| 59 | AB2072 | PANEL 2 | T/C LOCATION 1 |
| 60 | AB2073 | PANEL 2 | T/C LOCATION 1 |
| 61 | AB2074 | PANEL 2 | T/C LOCATION 1 |
| 62 | AB2075 | PANEL 2 | T/C LOCATION 1 |
| 63 | AB2076 | PANEL 2 | T/C LOCATION 1 |
| 64 | AB2077 | PANEL 2 | T/C LOCATION 1 |
| 65 | AB2078 | PANEL 2 | T/C LOCATION 1 |
| 66 | AB2079 | PANEL 2 | T/C LOCATION 1 |
| 67 | AB2080 | PANEL 2 | T/C LOCATION 1 |
| 68 | AB2081 | PANEL 2 | T/C LOCATION 1 |
| 69 | AB2082 | PANEL 2 | T/C LOCATION 1 |
| 70 | AB2083 | PANEL 2 | T/C LOCATION 1 |
| 71 | AB2084 | PANEL 2 | T/C LOCATION 1 |
| 72 | AB2085 | PANEL 2 | T/C LOCATION 1 |
| 73 | AB2086 | PANEL 2 | T/C LOCATION 1 |
| 74 | AB2087 | PANEL 2 | T/C LOCATION 1 |
| 75 | AB2088 | PANEL 2 | T/C LOCATION 1 |
| 76 | AB2089 | PANEL 2 | T/C LOCATION 1 |
| 77 | AB2090 | PANEL 2 | T/C LOCATION 1 |
| 78 | AB2091 | PANEL 2 | T/C LOCATION 1 |
| 79 | AB2092 | PANEL 2 | T/C LOCATION 1 |
| 80 | AB2093 | PANEL 2 | T/C LOCATION 1 |
| 81 | AB2094 | PANEL 2 | T/C LOCATION 1 |
| 82 | AB2095 | PANEL 2 | T/C LOCATION 1 |
| 83 | AB2096 | PANEL 2 | T/C LOCATION 1 |
| 84 | AB2097 | PANEL 2 | T/C LOCATION 1 |
| 85 | AB2098 | PANEL 2 | T/C LOCATION 1 |
| 86 | AB2099 | PANEL 2 | T/C LOCATION 1 |
| 87 | AB2100 | PANEL 2 | T/C LOCATION 1 |
| 88 | AB2101 | PANEL 2 | T/C LOCATION 1 |
| 89 | AB2102 | PANEL 2 | T/C LOCATION 1 |
| 90 | AB2103 | | |



B-53

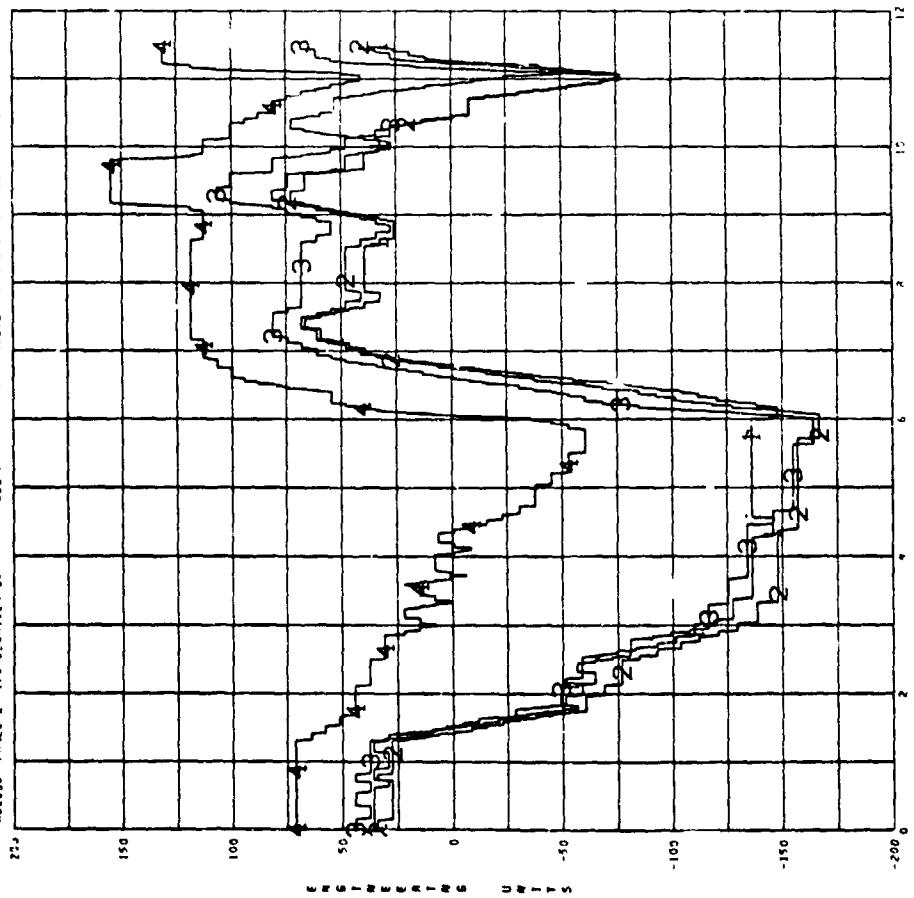
| INTEGRATED TEST DATA GROUP B- FLAMM EVALUATION | | | | |
|--|---------|-----------------|-------|---|
| 1 | 2 | 3 | 4 | 5 |
| AB2009 | PANEL 2 | T/C LOCATION 09 | DEG F | 2 |
| AB2010 | PANEL 2 | T/C LOCATION 10 | DEG F | 2 |
| AB2011 | PANEL 2 | T/C LOCATION 11 | DEG F | 2 |
| AB2012 | PANEL 2 | T/C LOCATION 12 | DEG F | 2 |
| AB2013 | PANEL 2 | T/C LOCATION 13 | DEG F | 2 |
| AB2014 | PANEL 2 | T/C LOCATION 14 | DEG F | 2 |
| AB2015 | PANEL 2 | T/C LOCATION 15 | DEG F | 2 |
| AB2016 | PANEL 2 | T/C LOCATION 16 | DEG F | 2 |
| AB2017 | PANEL 2 | T/C LOCATION 17 | DEG F | 2 |
| AB2018 | PANEL 2 | T/C LOCATION 18 | DEG F | 2 |
| AB2019 | PANEL 2 | T/C LOCATION 19 | DEG F | 2 |
| AB2020 | PANEL 2 | T/C LOCATION 20 | DEG F | 2 |
| AB2021 | PANEL 2 | T/C LOCATION 21 | DEG F | 2 |
| AB2022 | PANEL 2 | T/C LOCATION 22 | DEG F | 2 |
| AB2023 | PANEL 2 | T/C LOCATION 23 | DEG F | 2 |
| AB2024 | PANEL 2 | T/C LOCATION 24 | DEG F | 2 |
| AB2025 | PANEL 2 | T/C LOCATION 25 | DEG F | 2 |
| AB2026 | PANEL 2 | T/C LOCATION 26 | DEG F | 2 |
| AB2027 | PANEL 2 | T/C LOCATION 27 | DEG F | 2 |
| AB2028 | PANEL 2 | T/C LOCATION 28 | DEG F | 2 |
| AB2029 | PANEL 2 | T/C LOCATION 29 | DEG F | 2 |
| AB2030 | PANEL 2 | T/C LOCATION 30 | DEG F | 2 |



B-54

INTEGRATED TEST DATA GROUP B - FLASH EVAPORATION

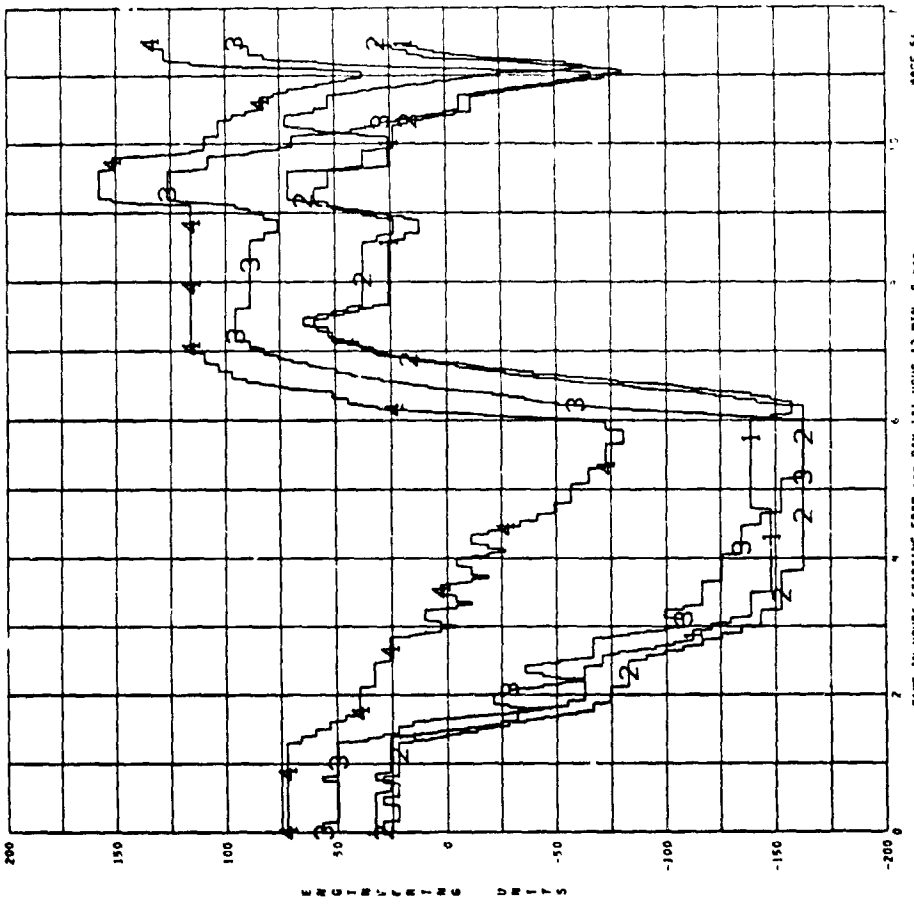
1 AB2005 PANEL 2 T/C LOCATION 01 DEG F
2 AB2031 PANEL 2 T/C LOCATION 31 DEG F
3 AB2036 PANEL 2 T/C LOCATION 34 DEG F
4 AB2024 PANEL 2 T/C LOCATION 24 DEG F



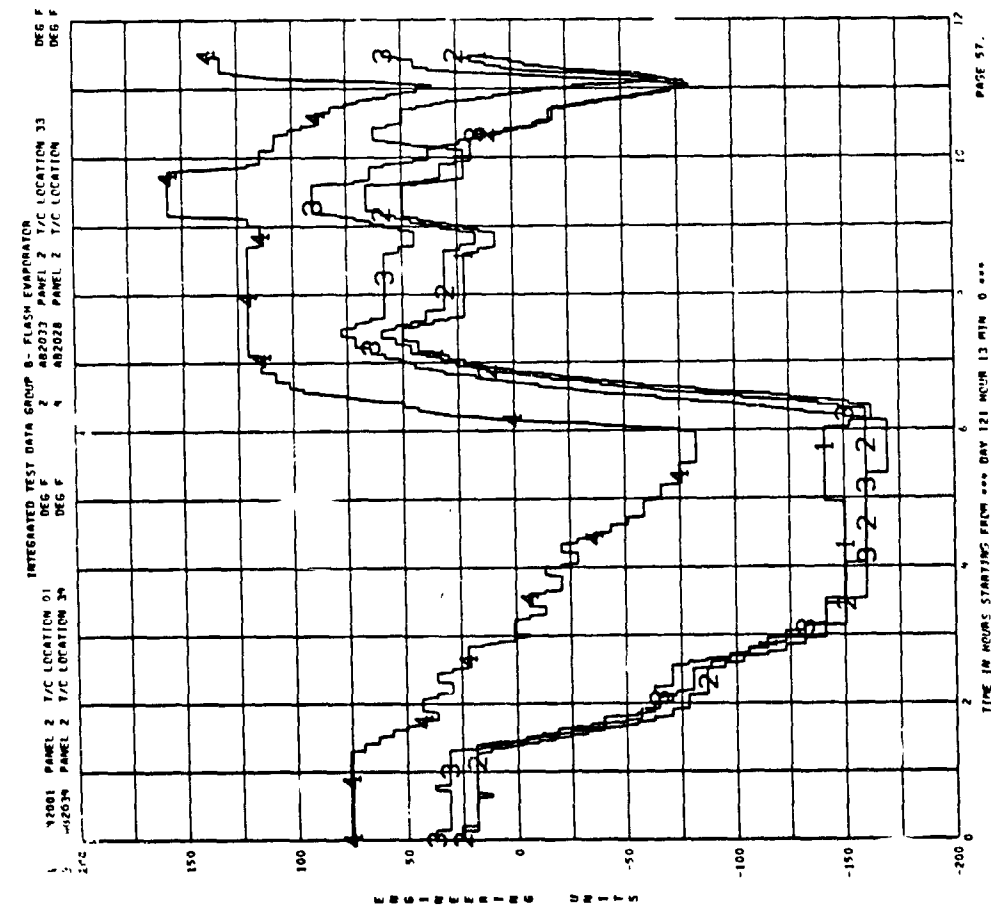
B-55

INTEGRATED TEST DATA GROUP B - FLASH EVAPORATION

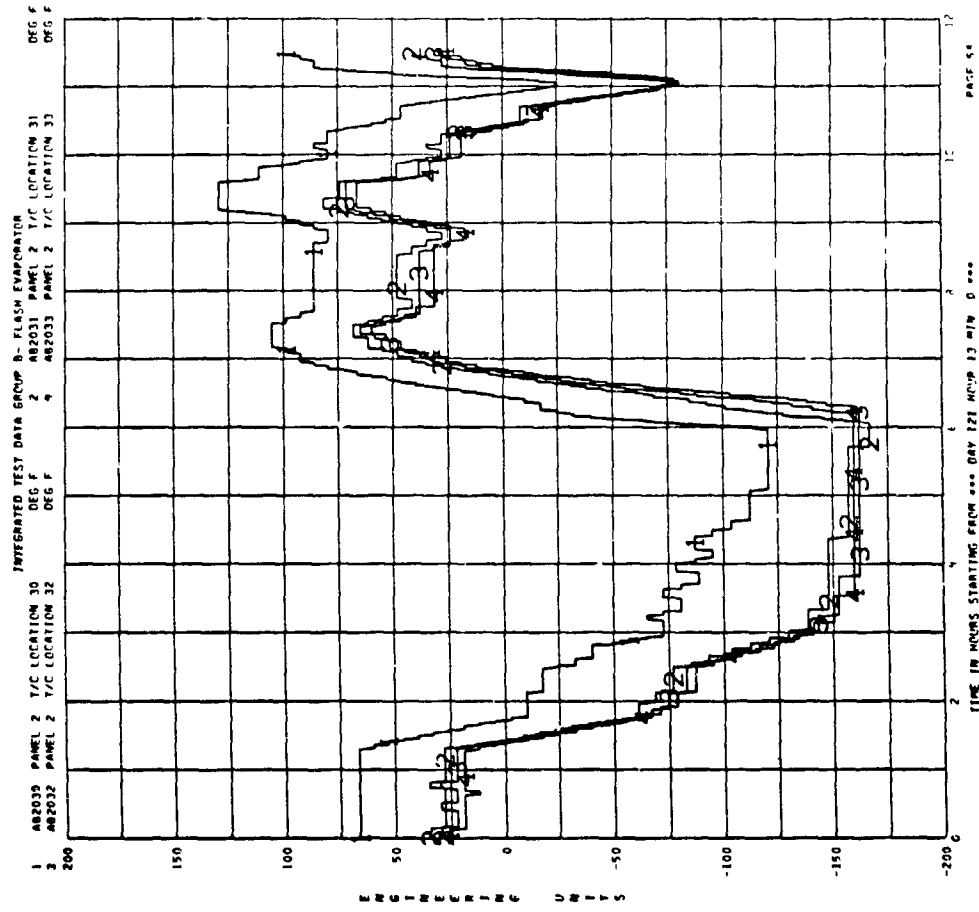
1 AB2003 PANEL 2 T/C LOCATION 03 DEG F
2 AB2032 PANEL 2 T/C LOCATION 32 DEG F
3 AB2037 PANEL 2 T/C LOCATION 37 DEG F
4 AB2026 PANEL 2 T/C LOCATION 26 DEG F



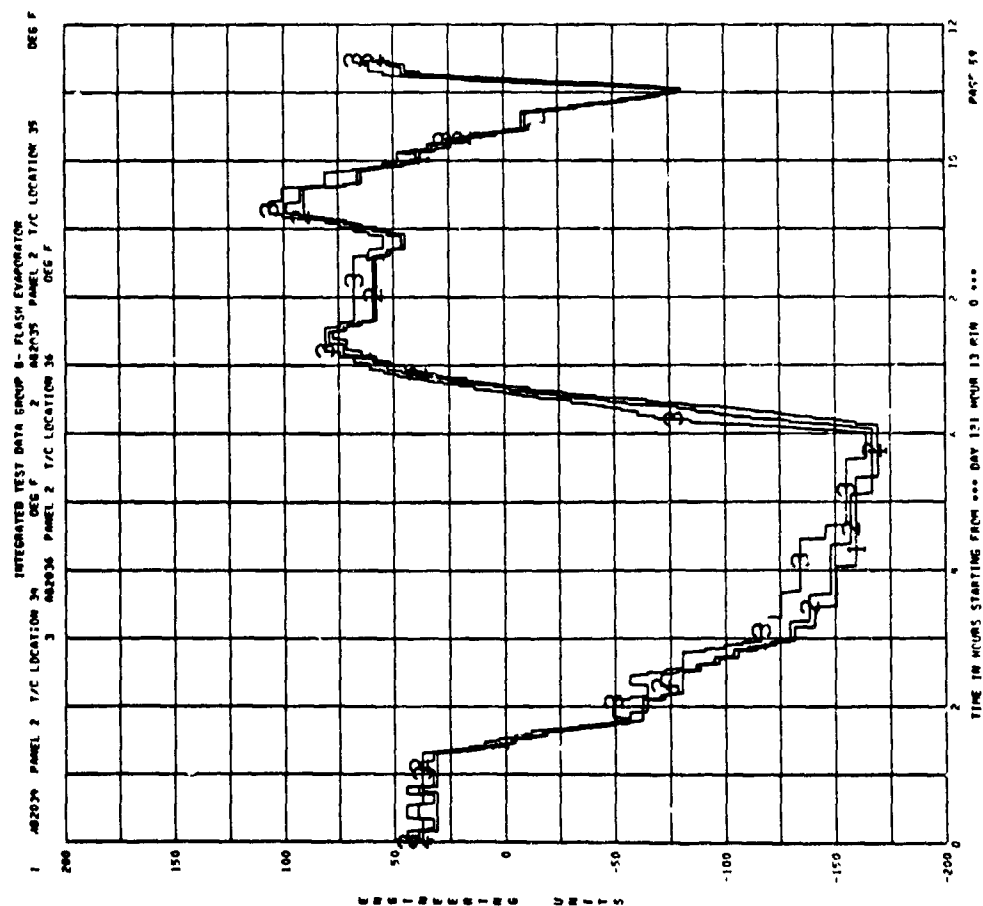
B-56



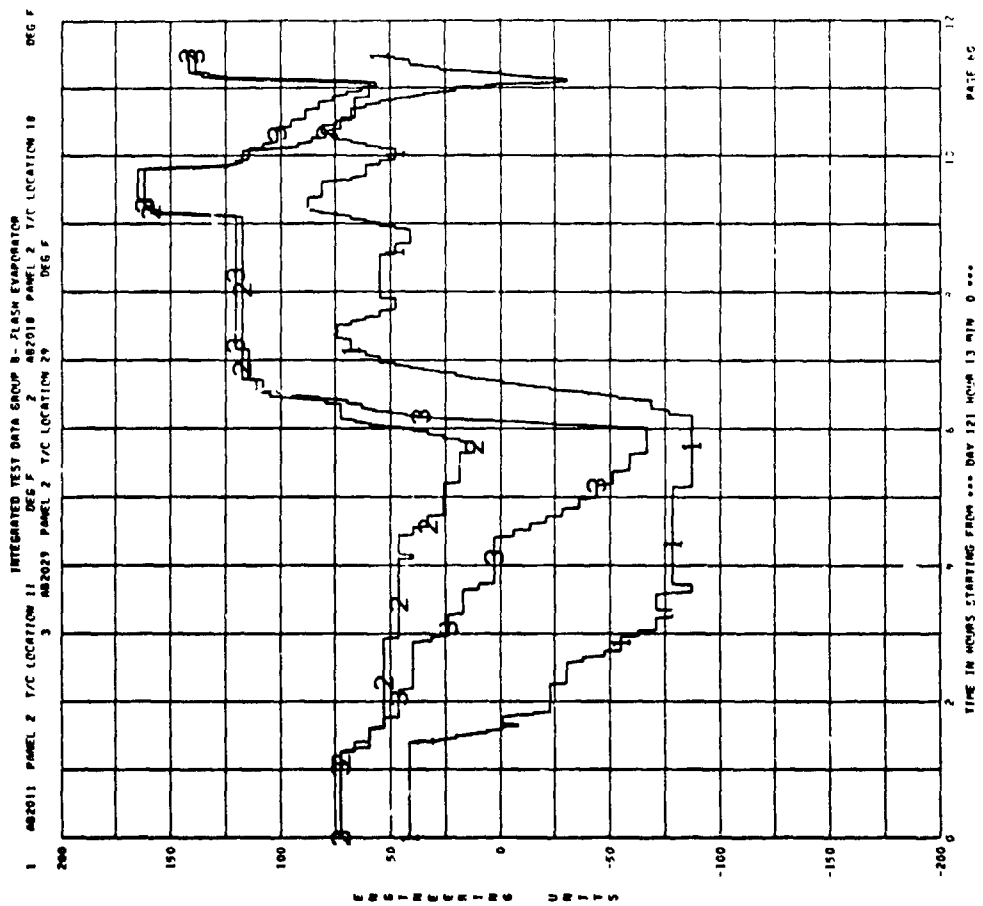
B-57



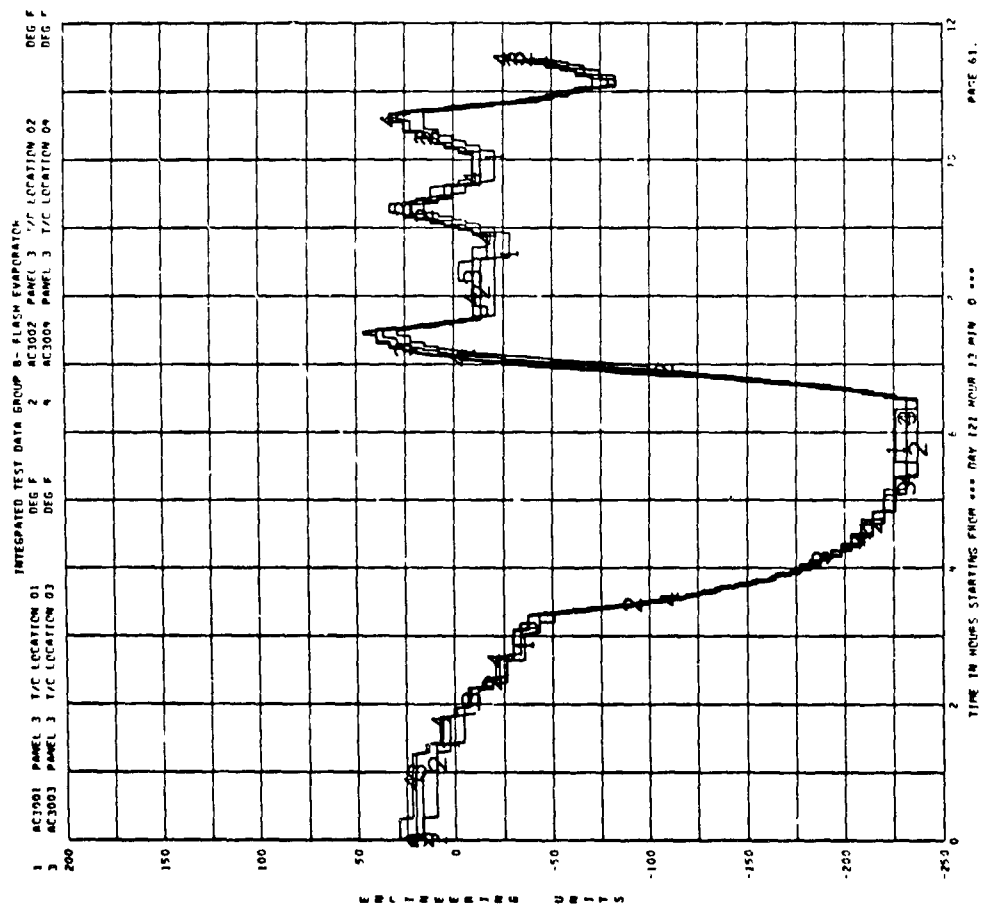
B-58



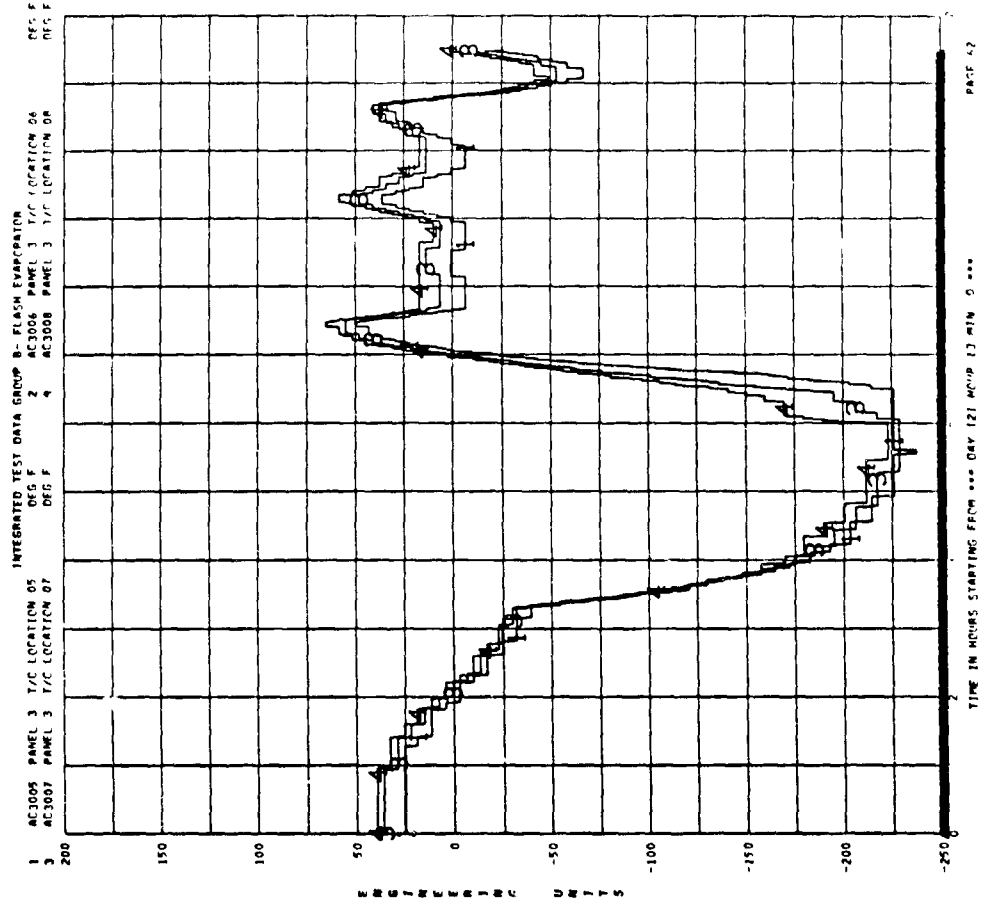
B-59



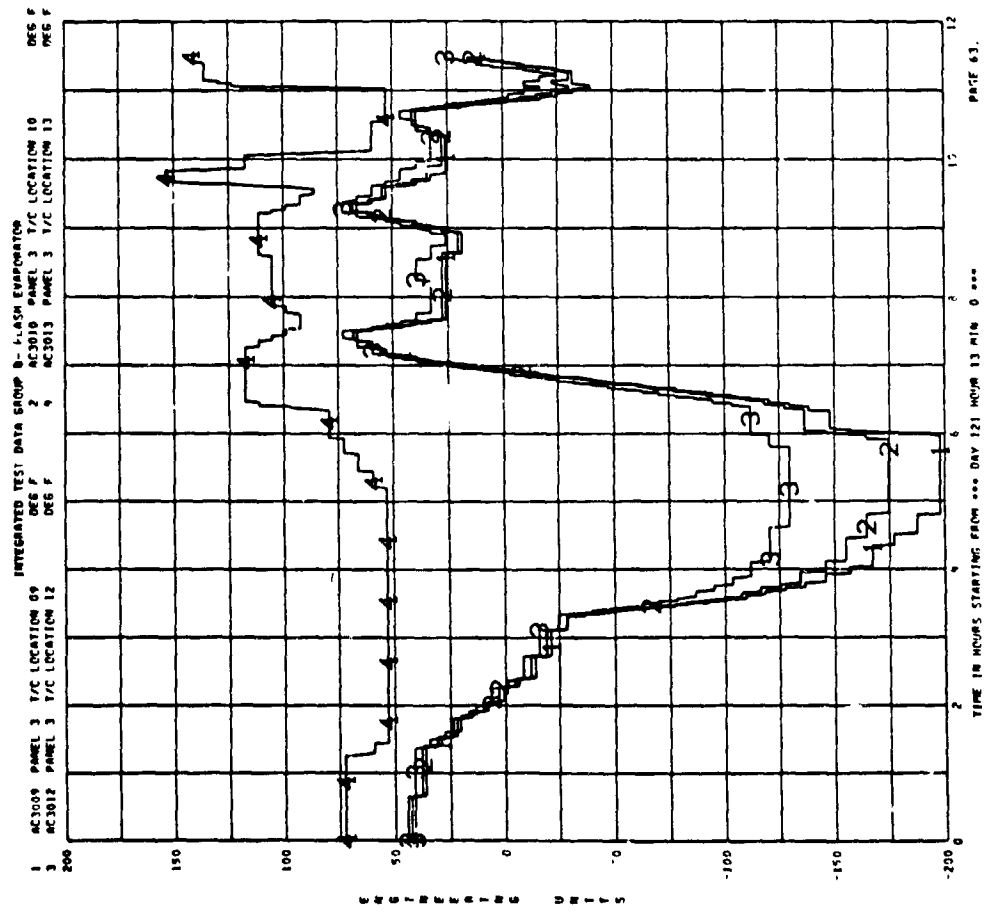
B-60



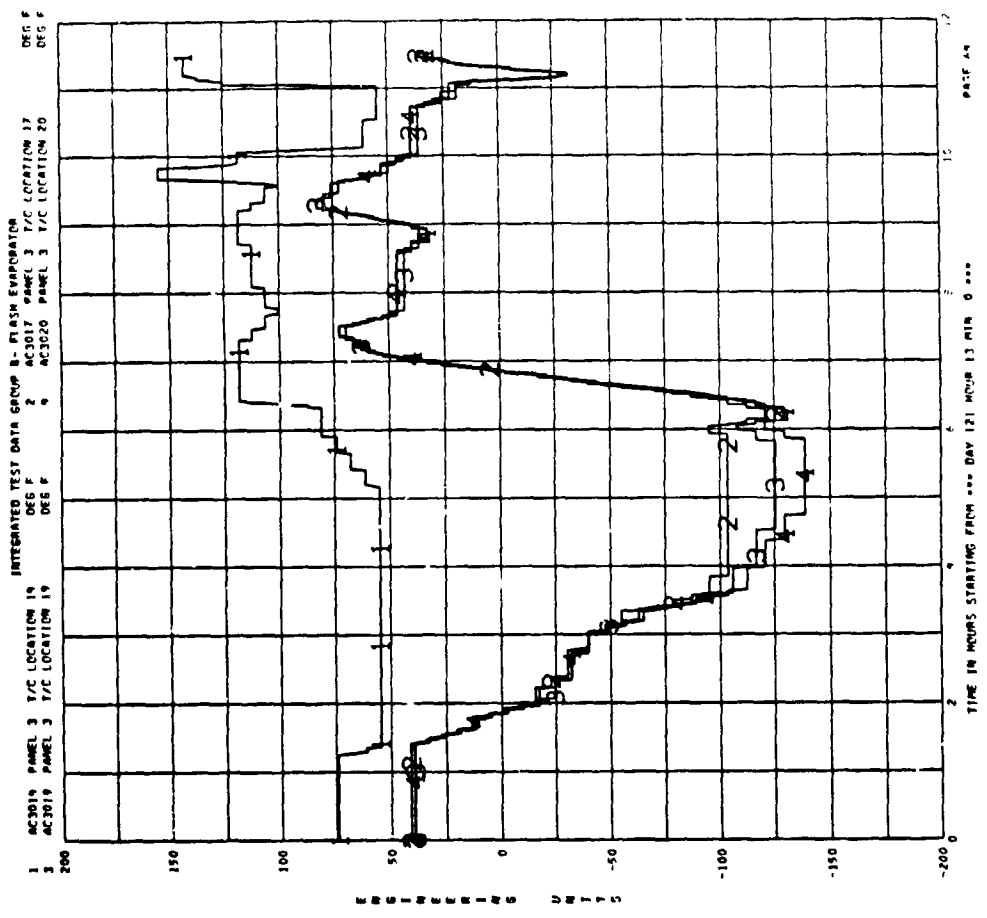
B-61



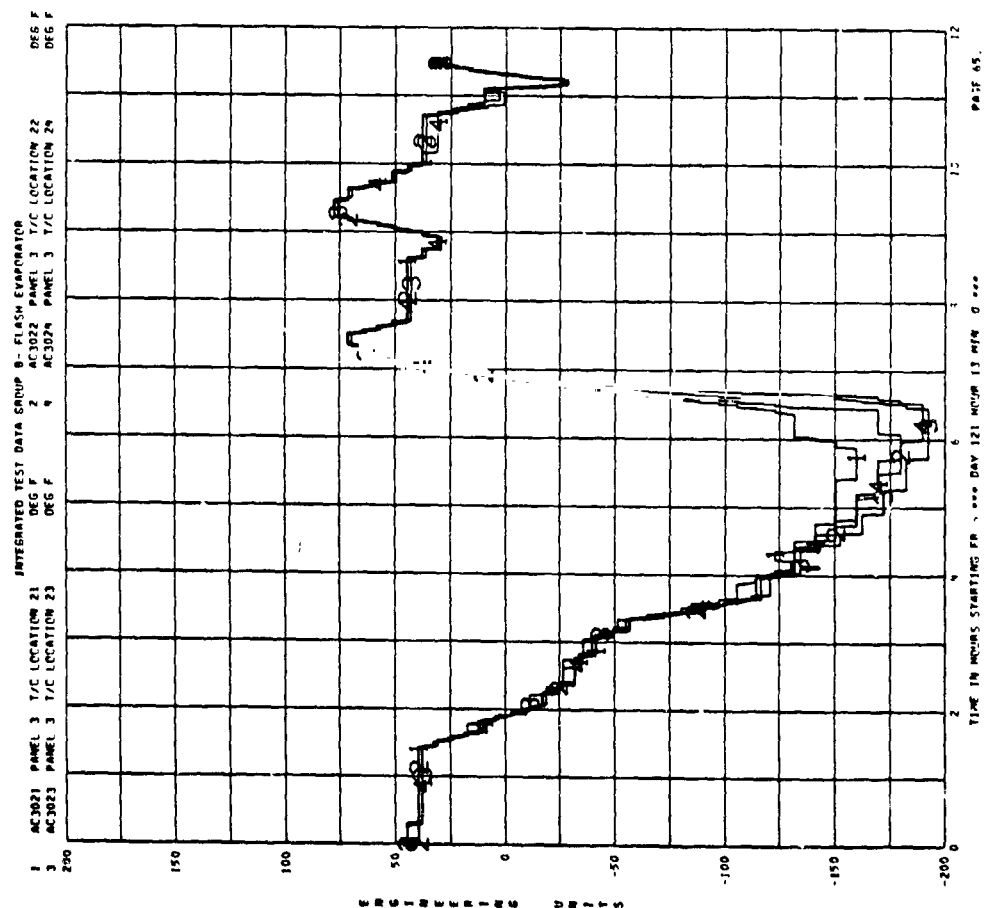
B-62



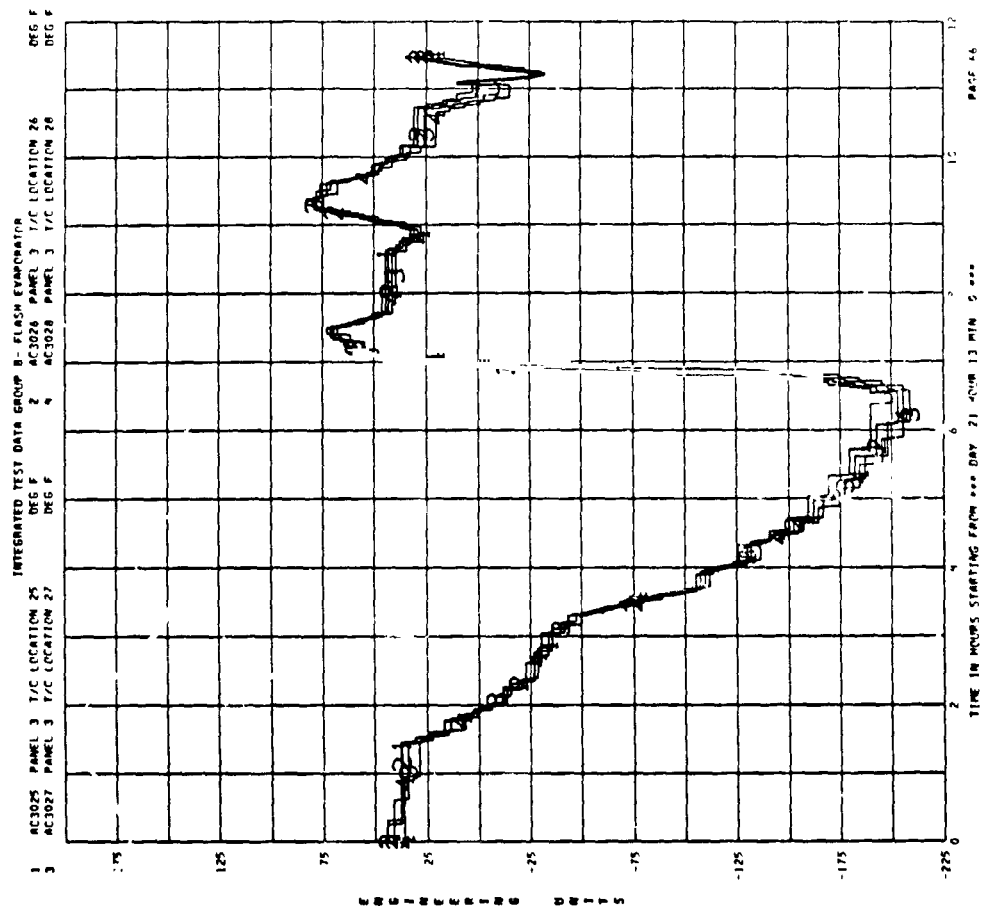
B-63



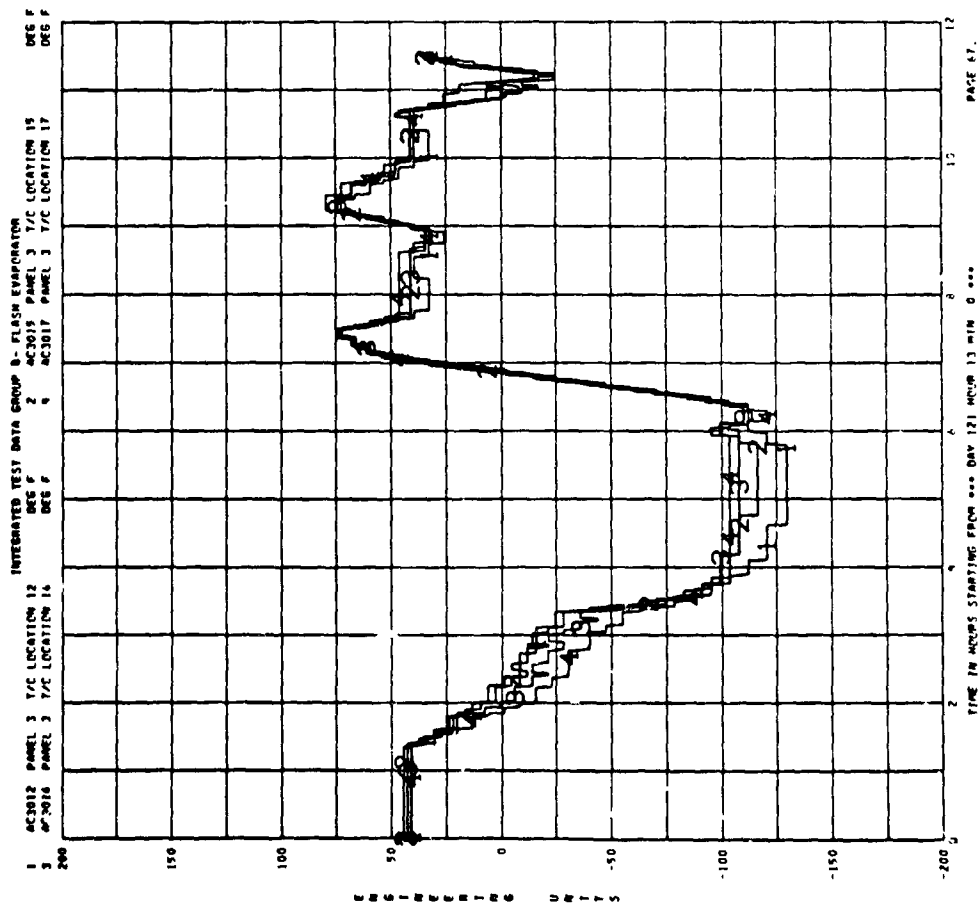
B-64



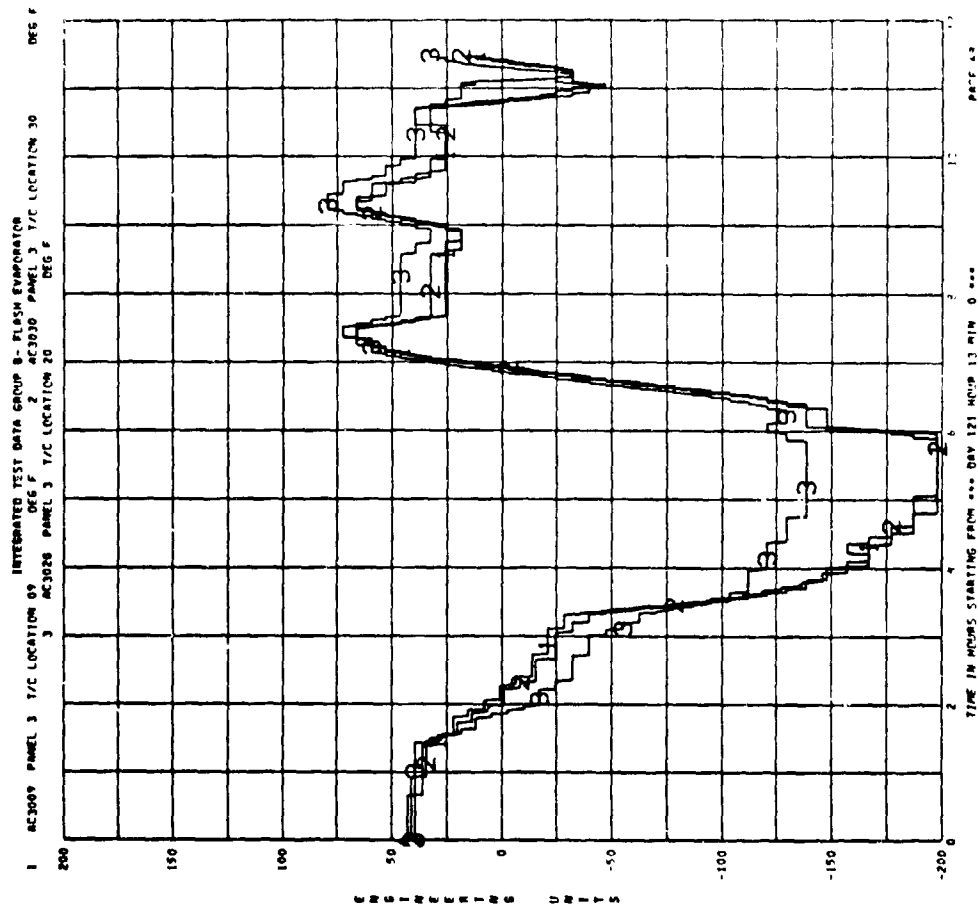
B-65



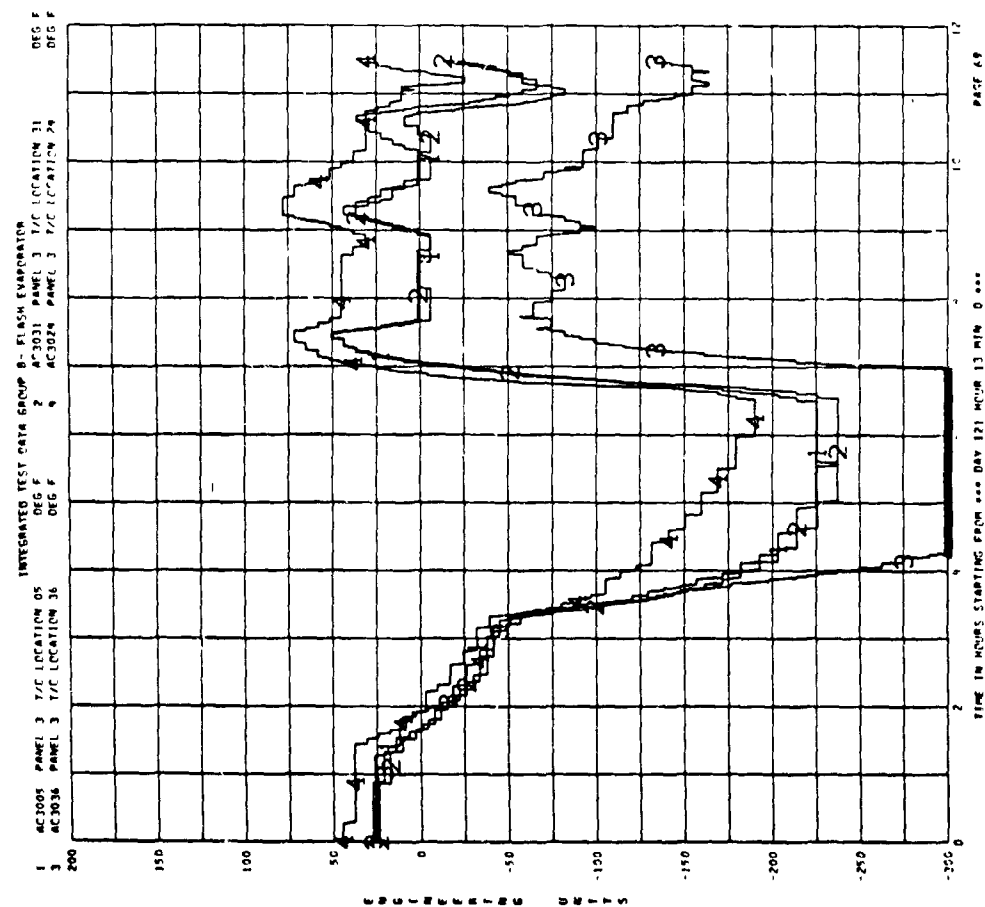
B-66



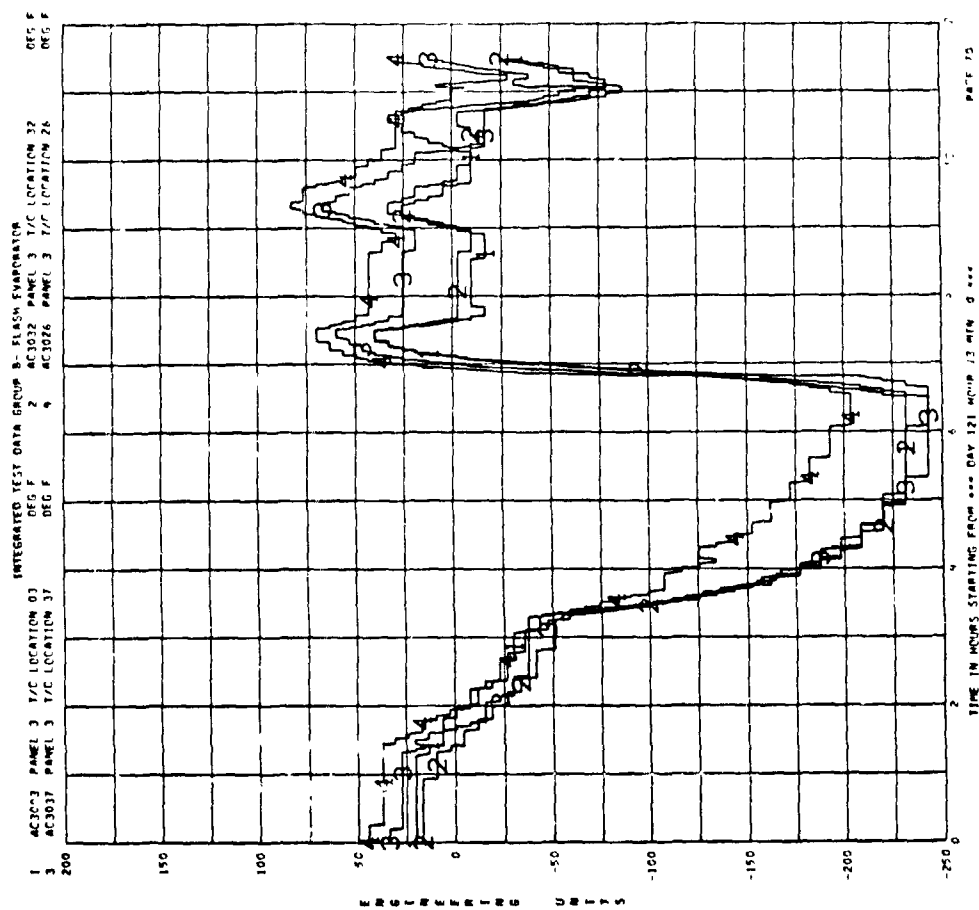
B-67



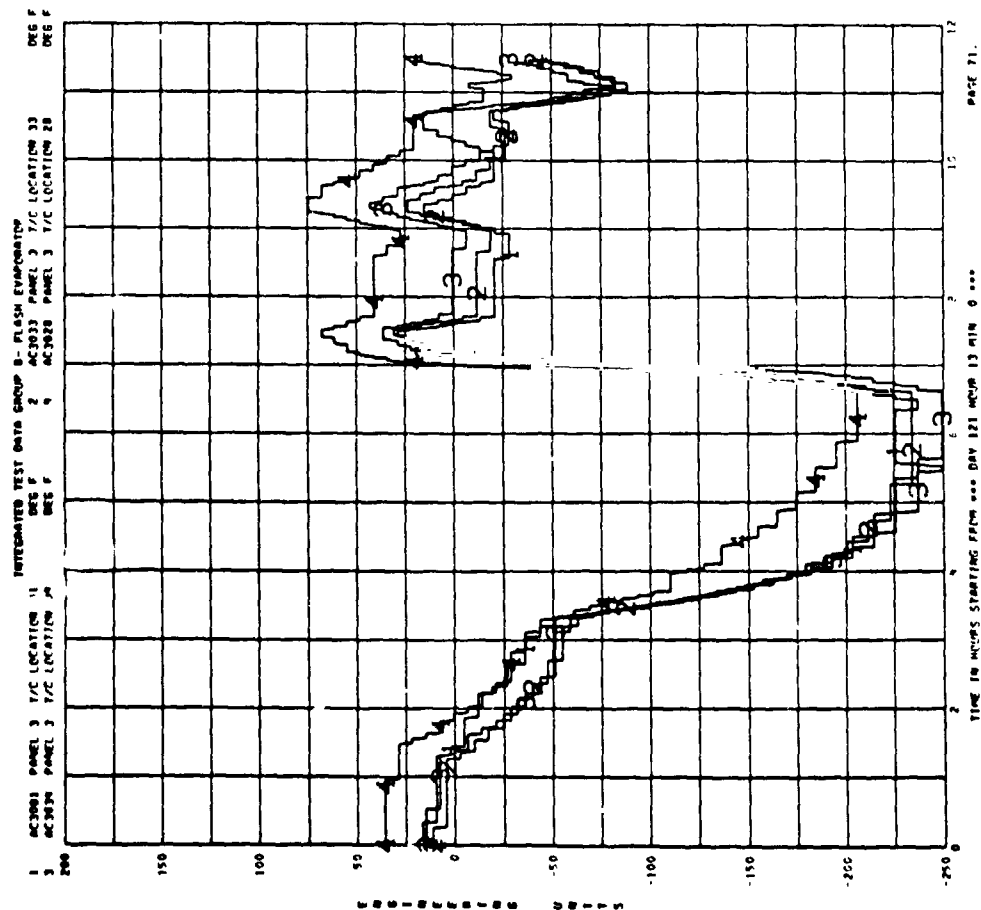
B-68



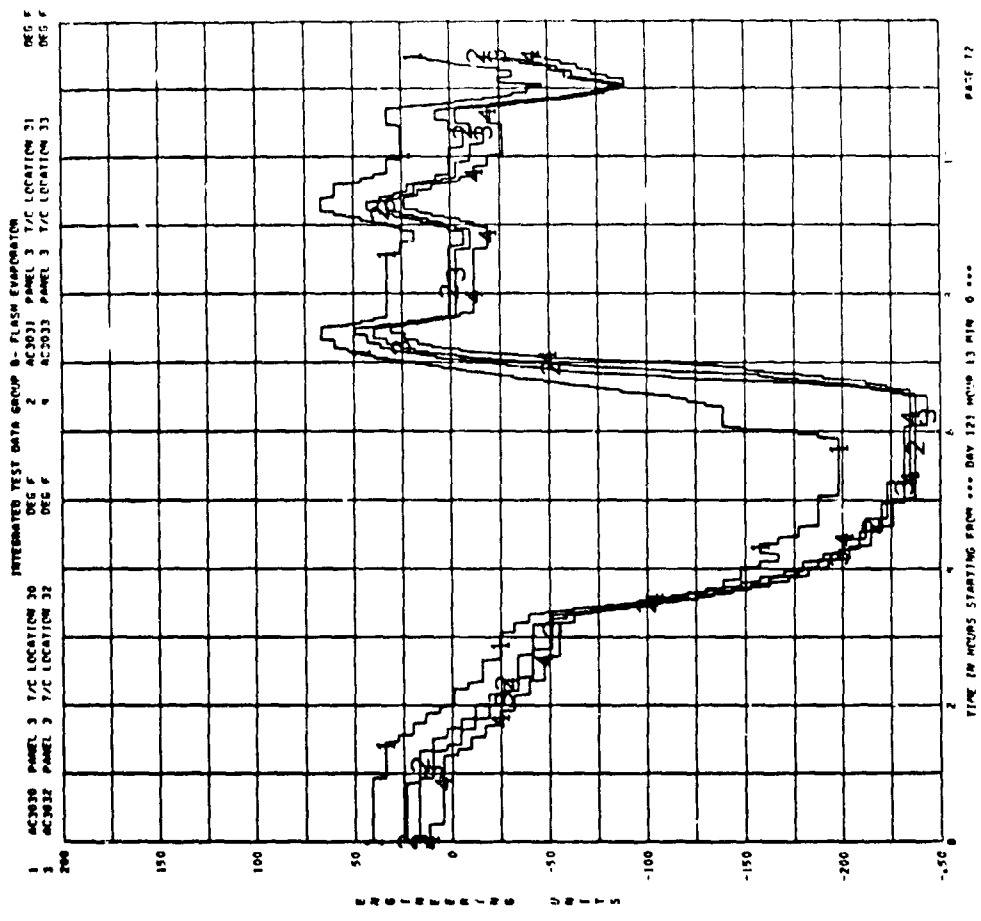
B-69



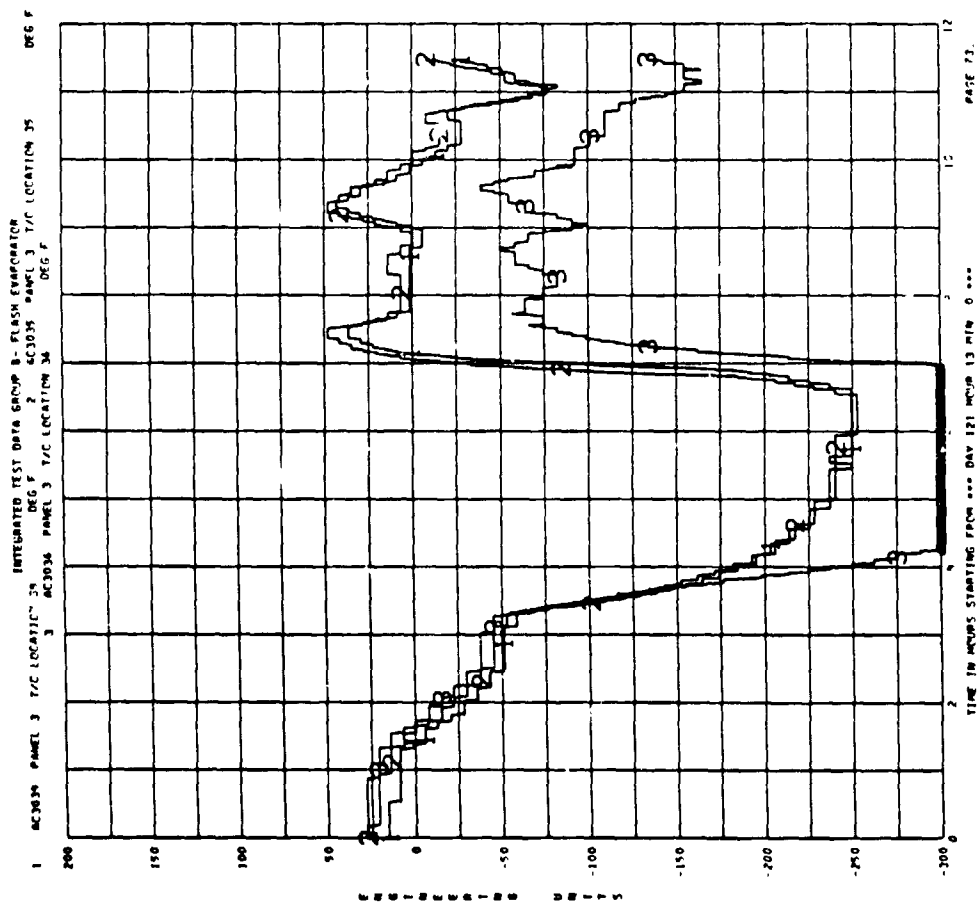
B-70



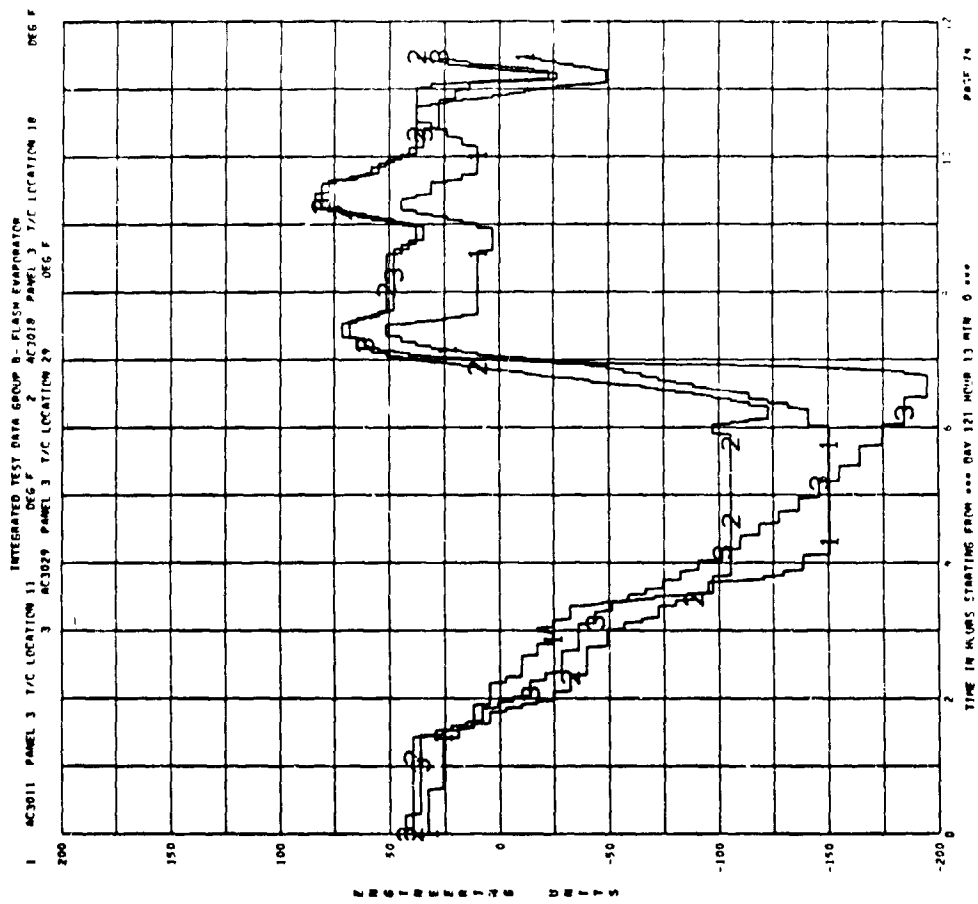
B-71



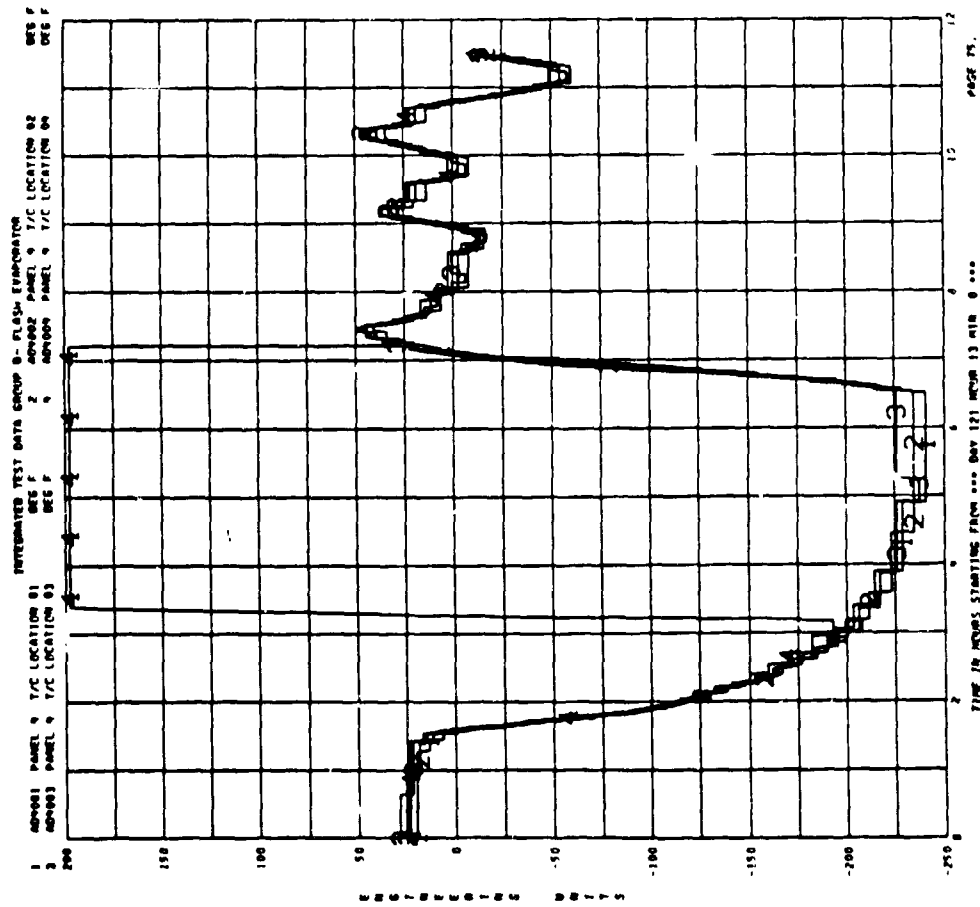
B-72



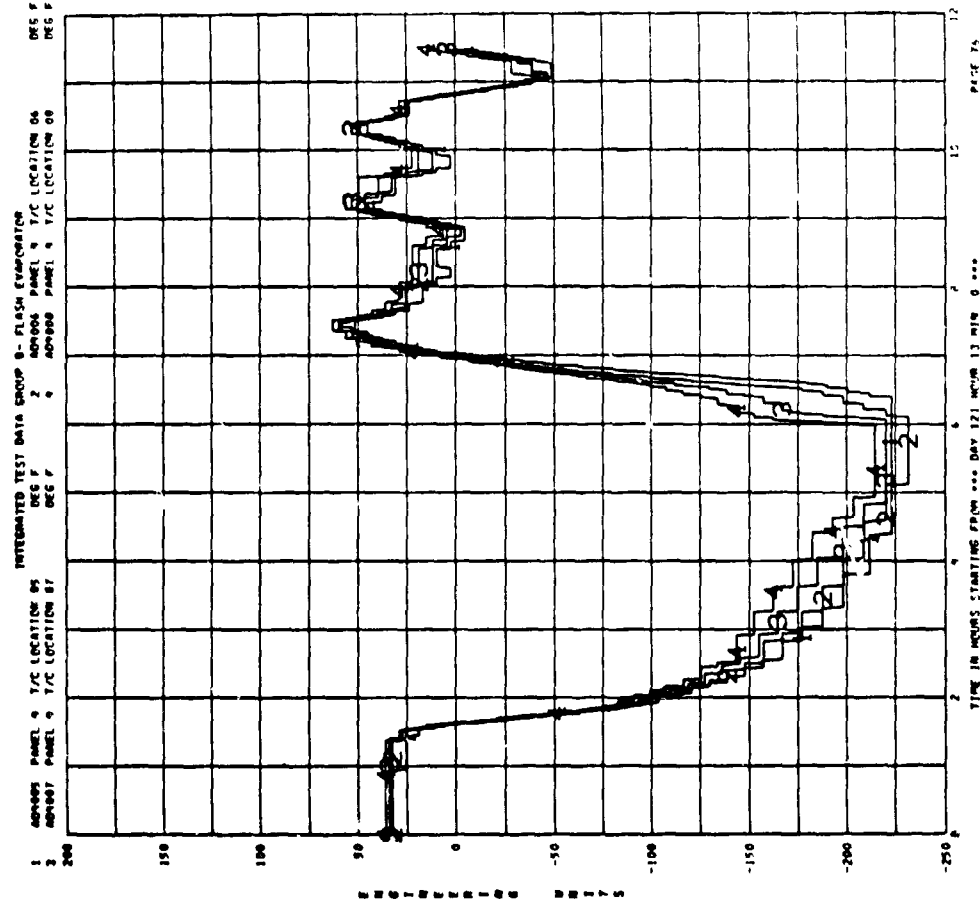
B-73



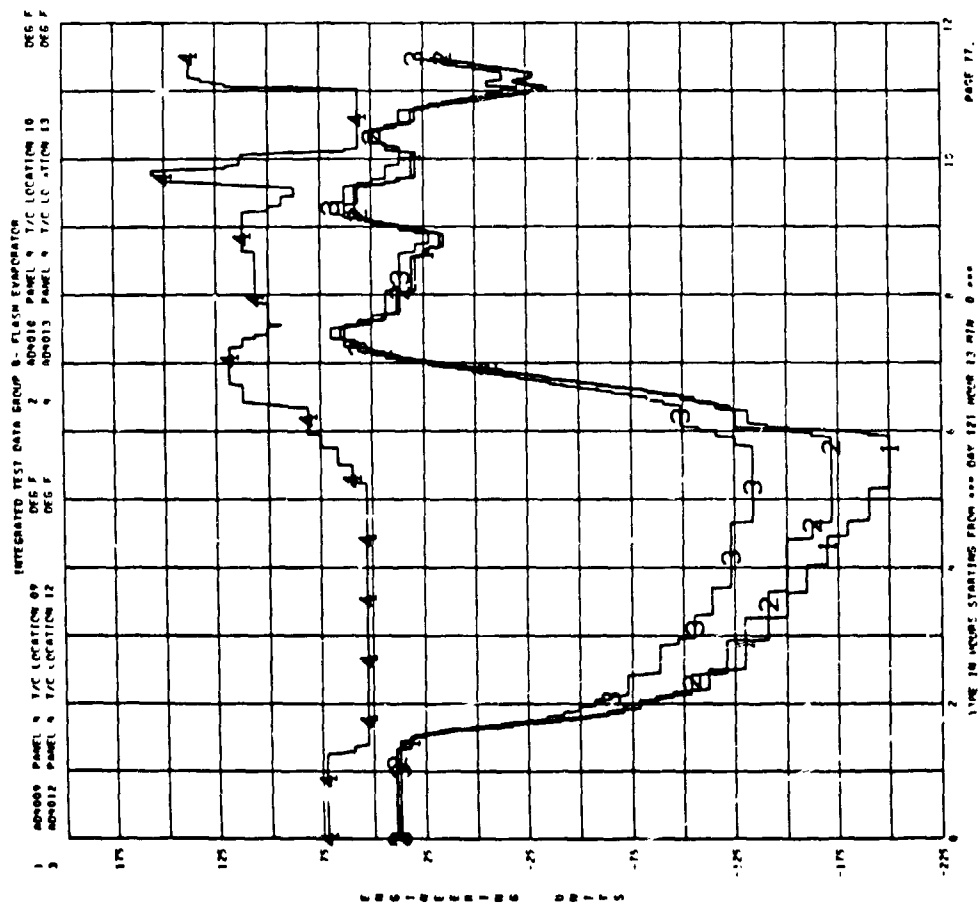
B-74



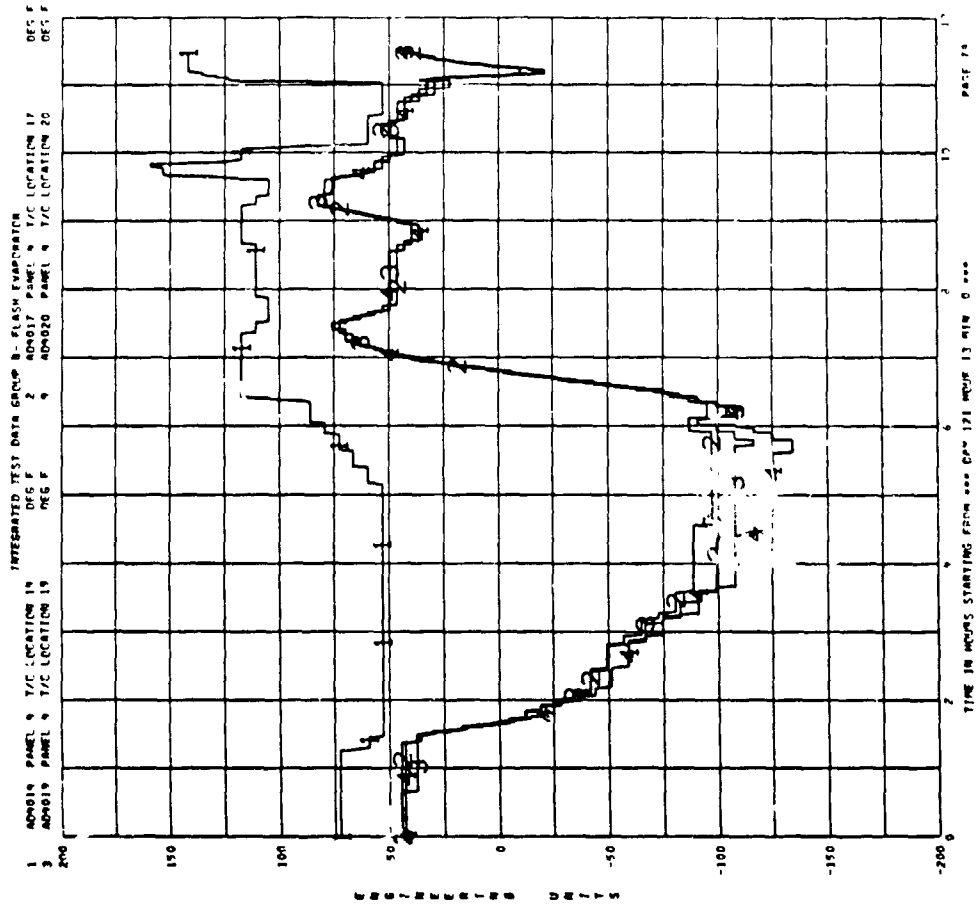
B-75



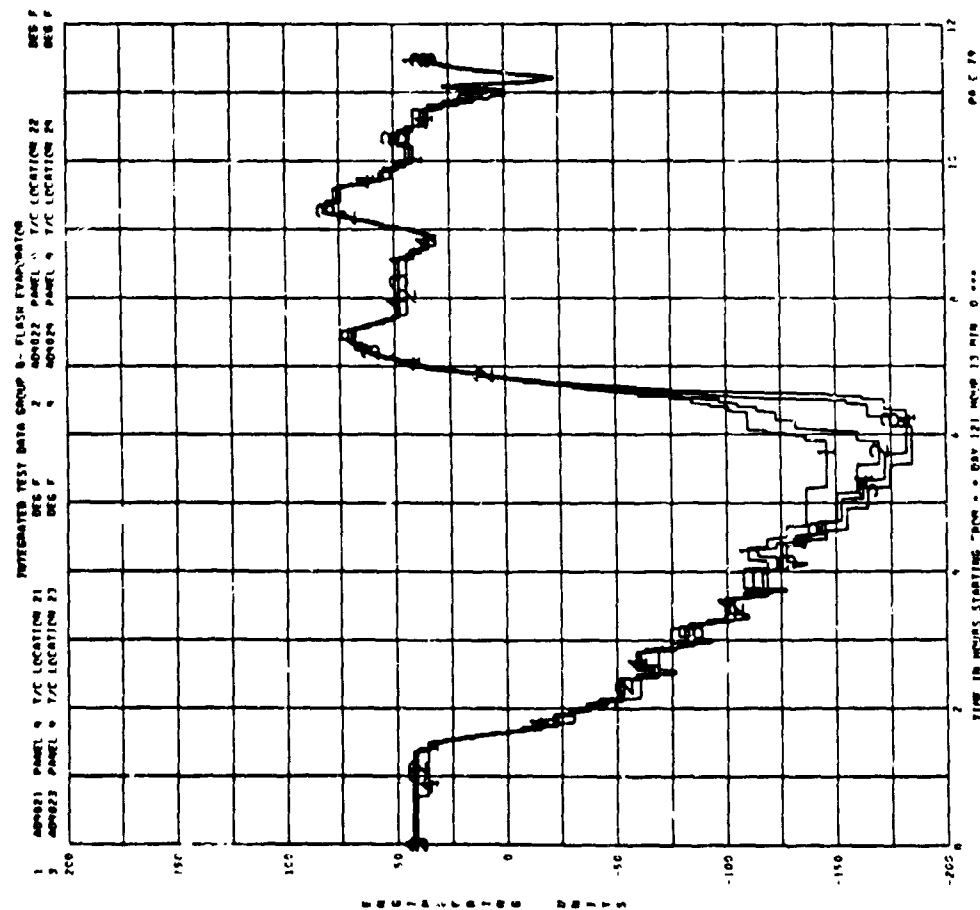
B-76



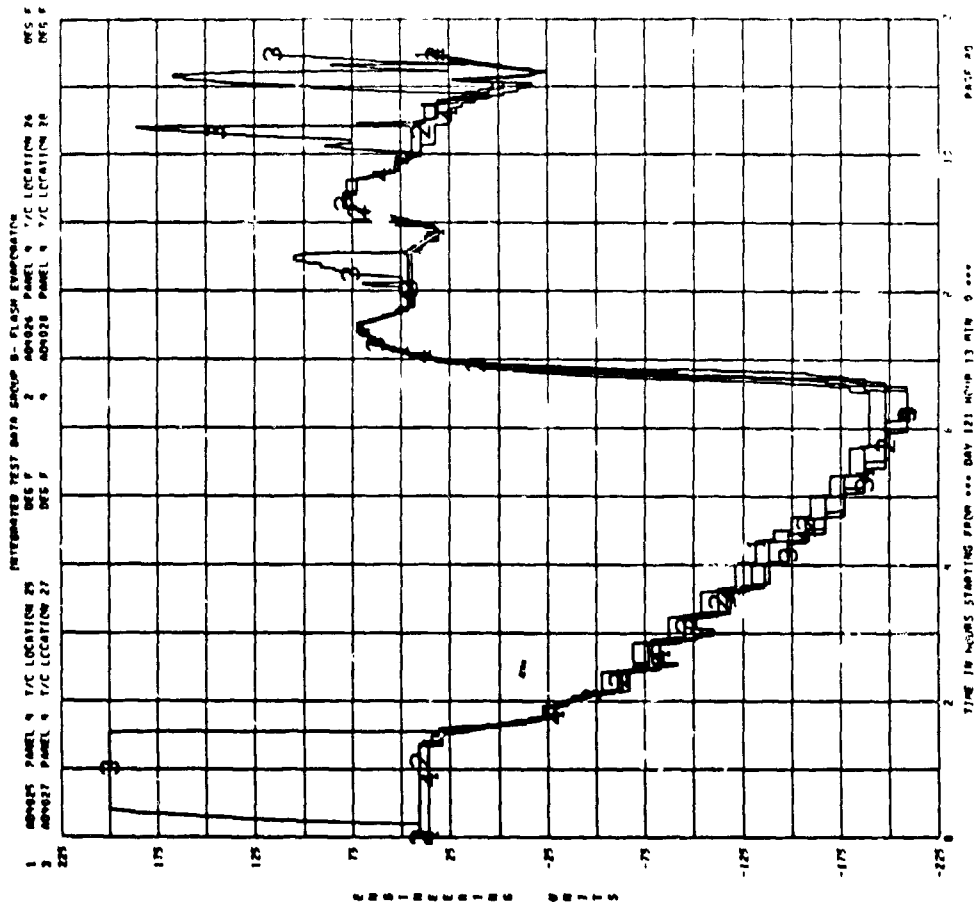
B-77



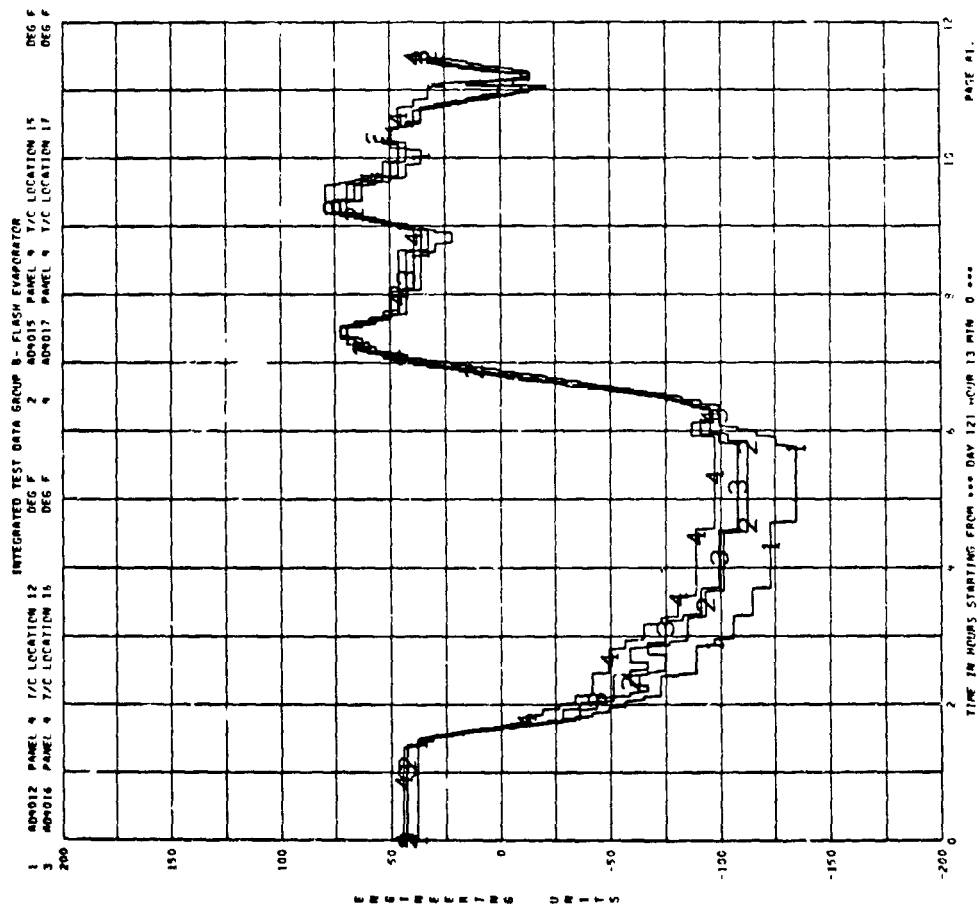
B-78



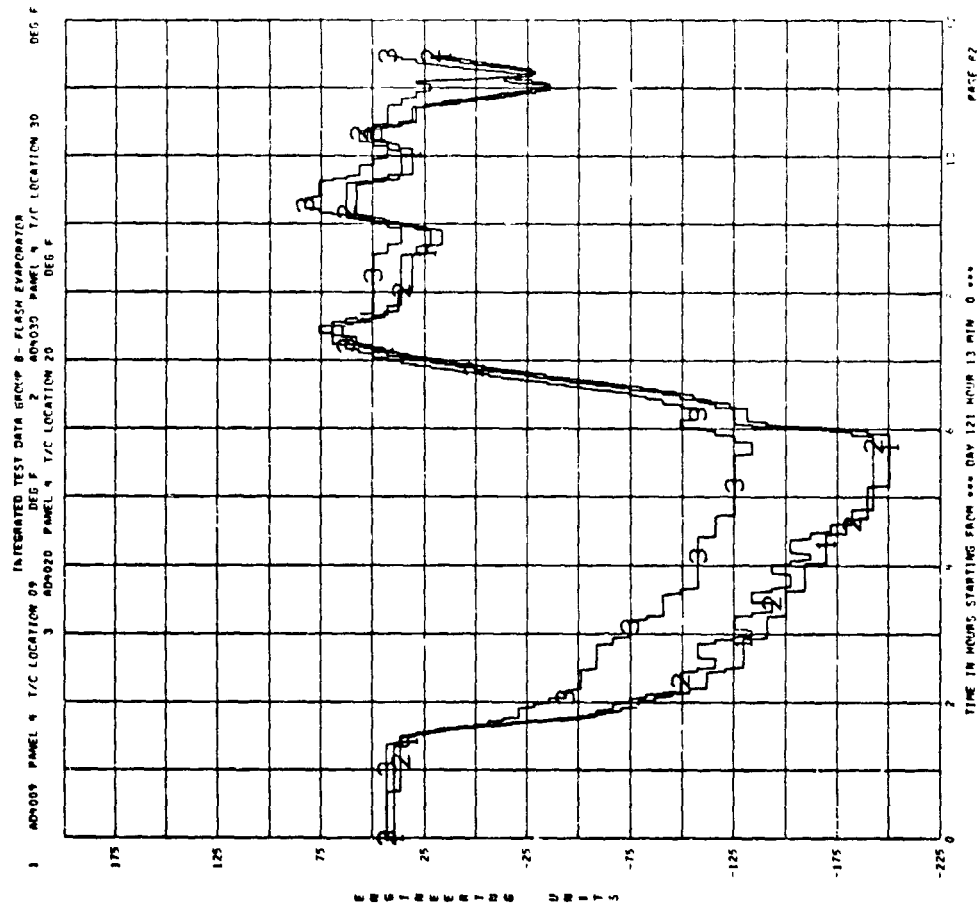
B-79



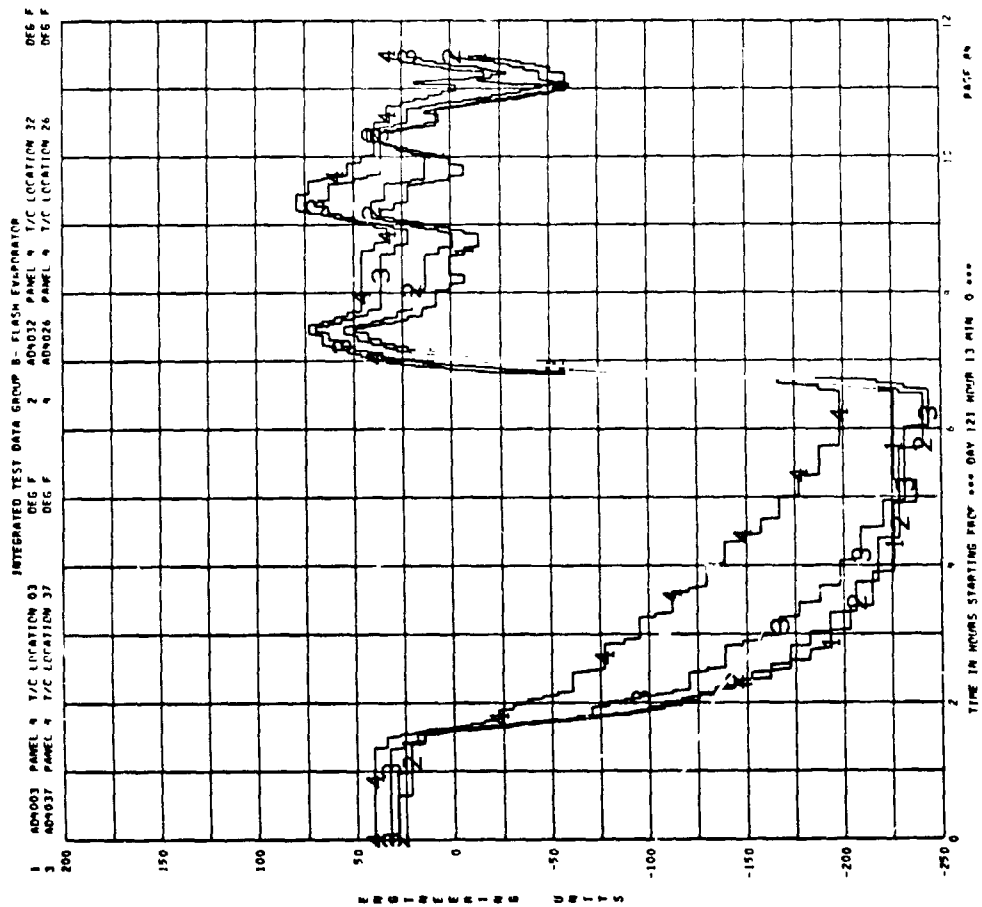
B-80



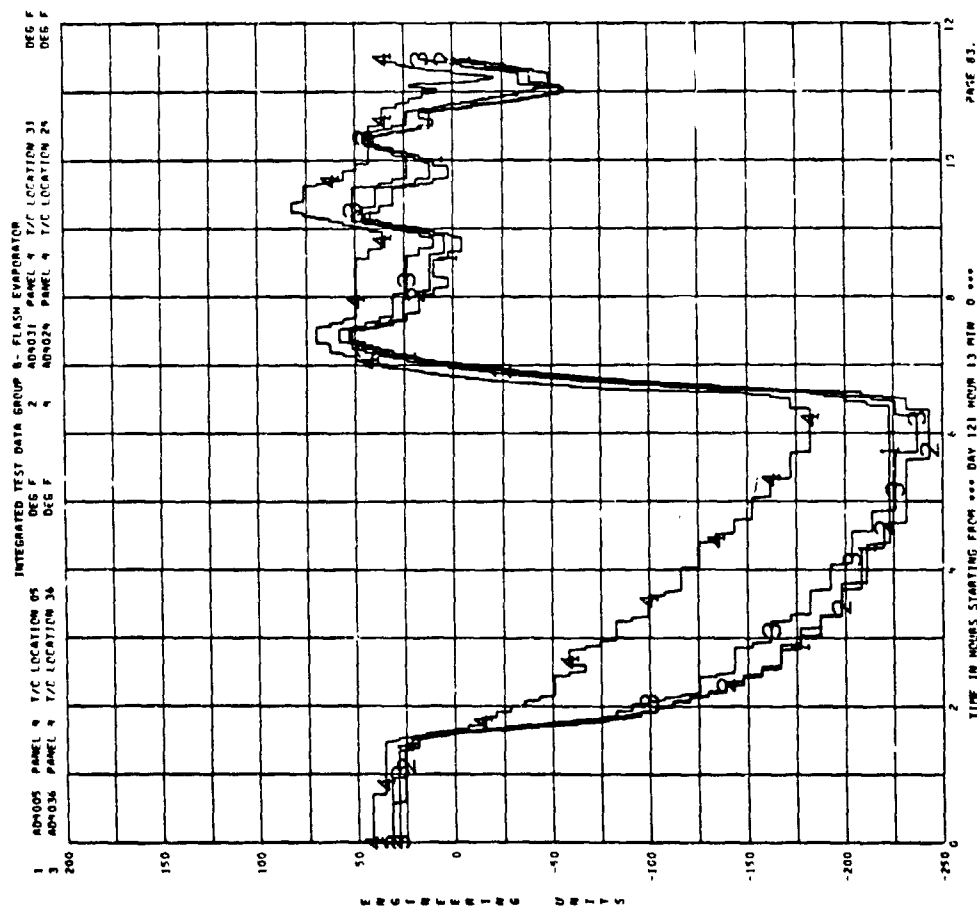
B-81



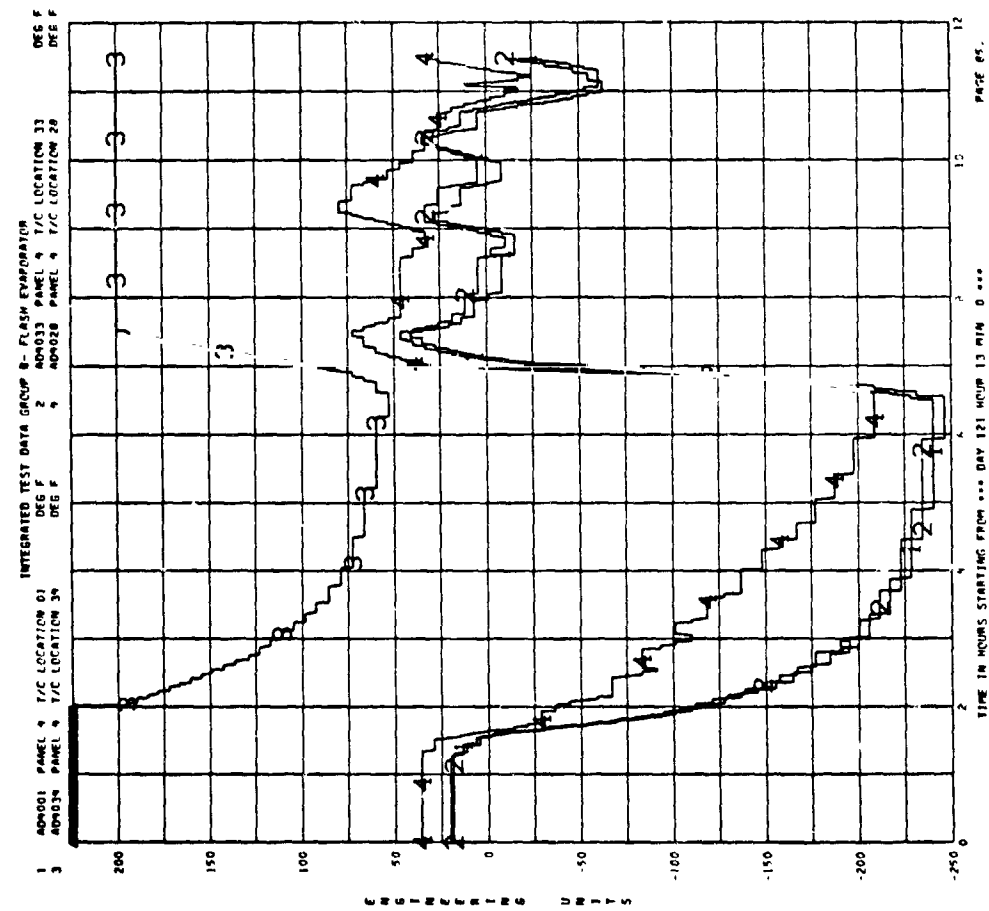
B-82



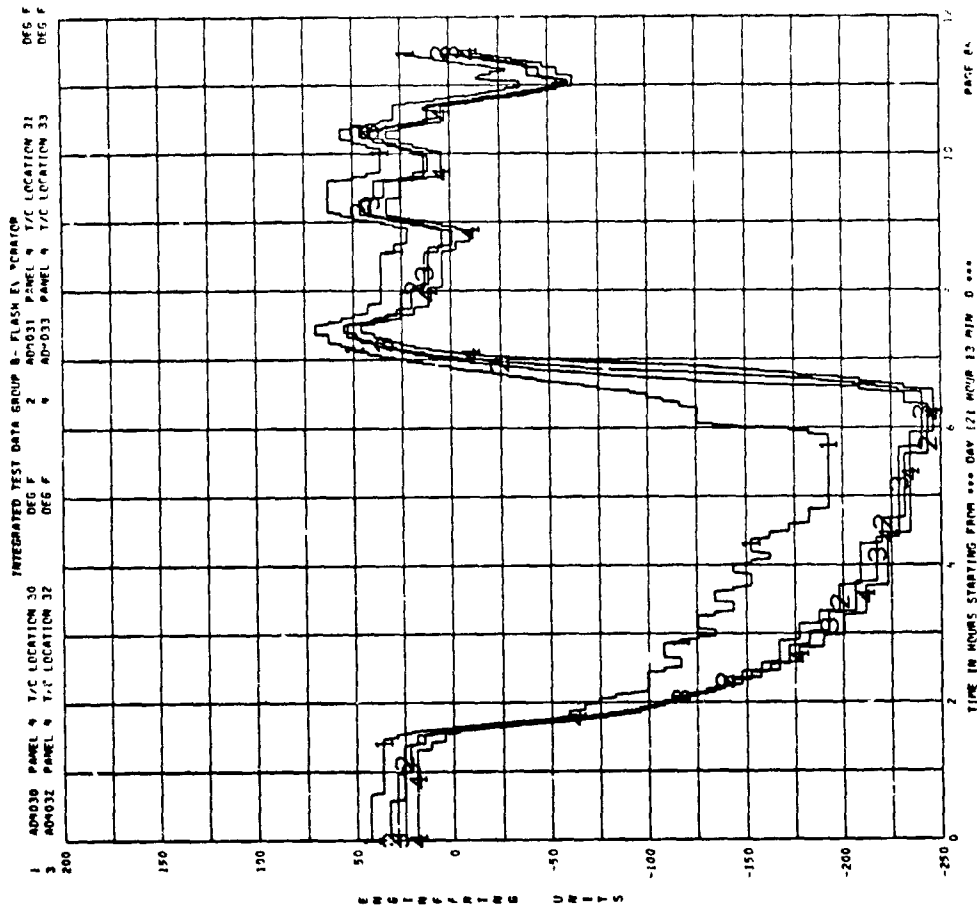
B-84



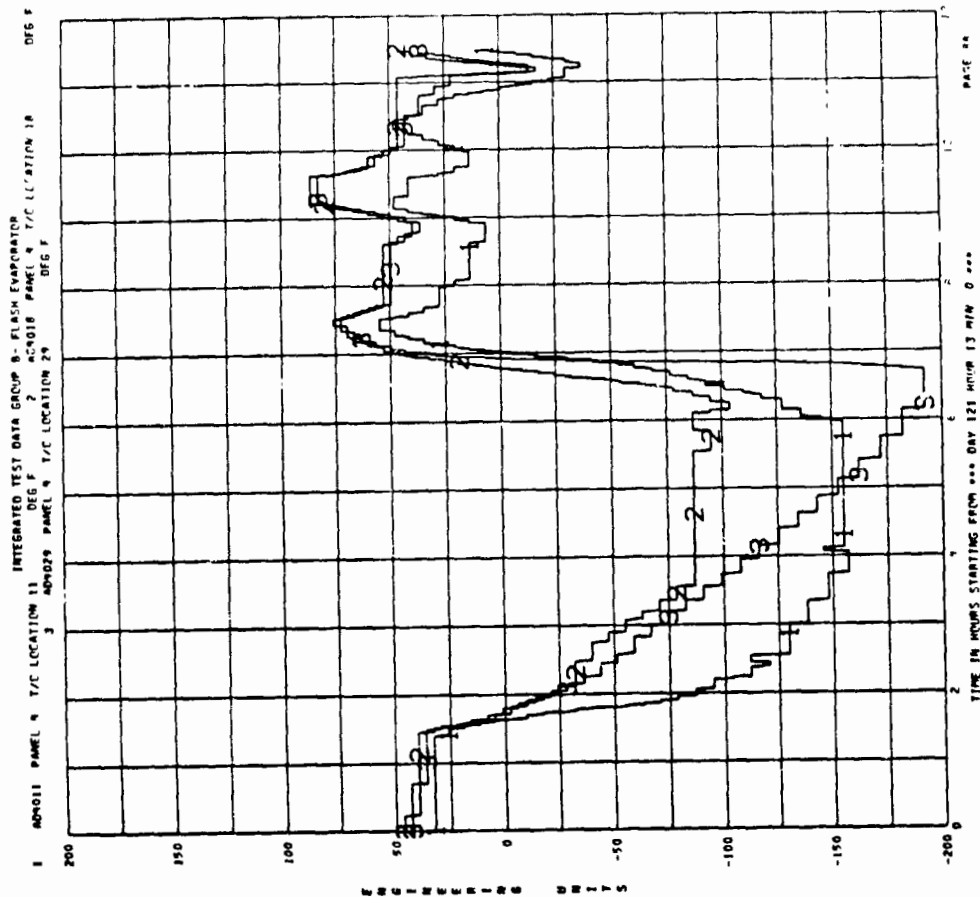
B-83



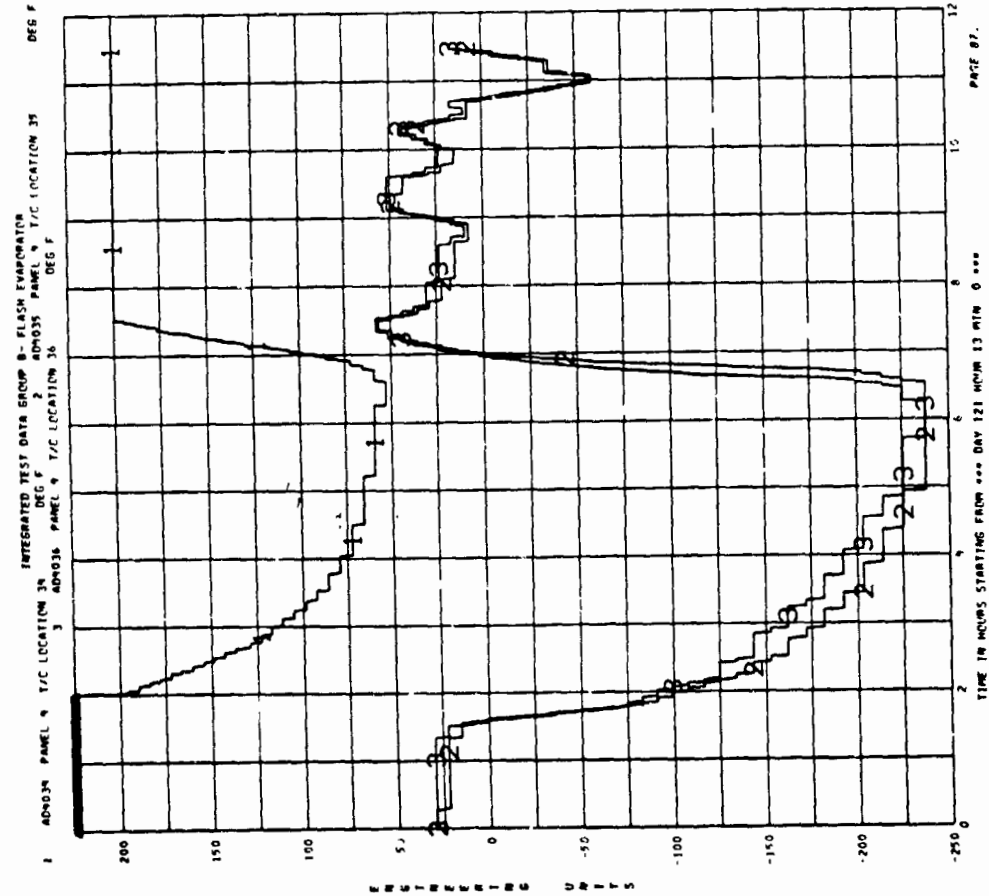
B-85



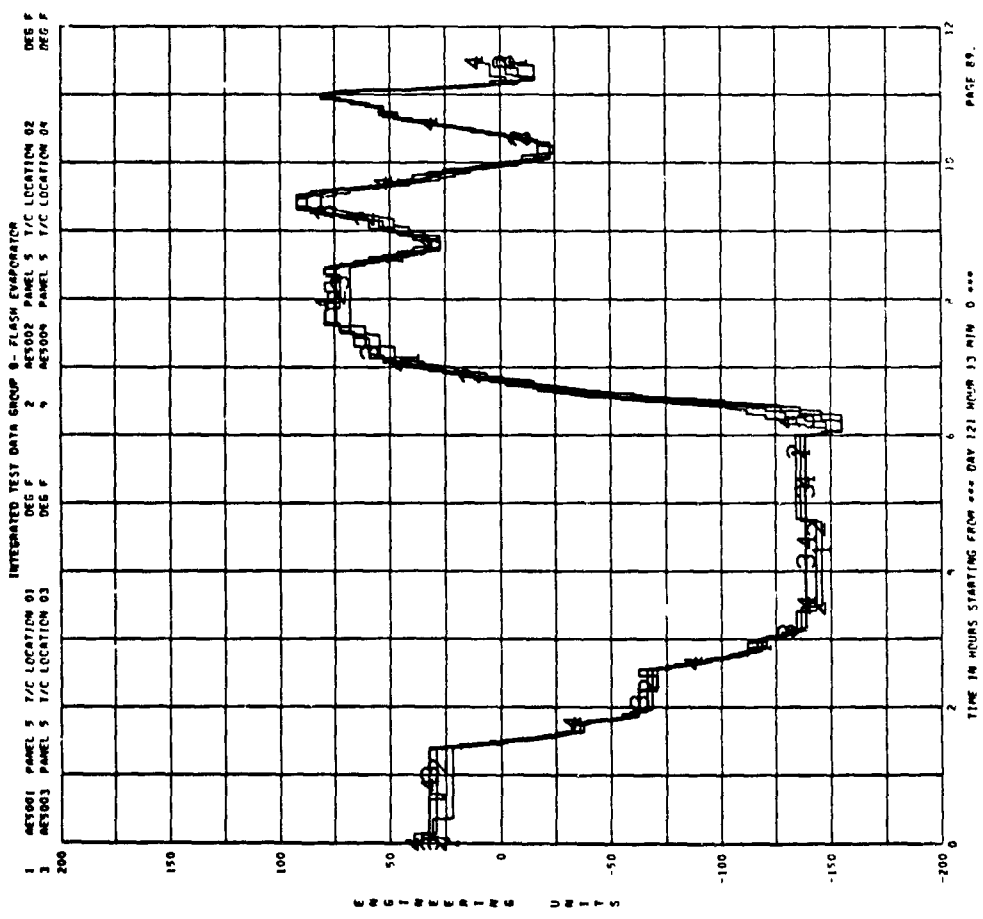
B-86



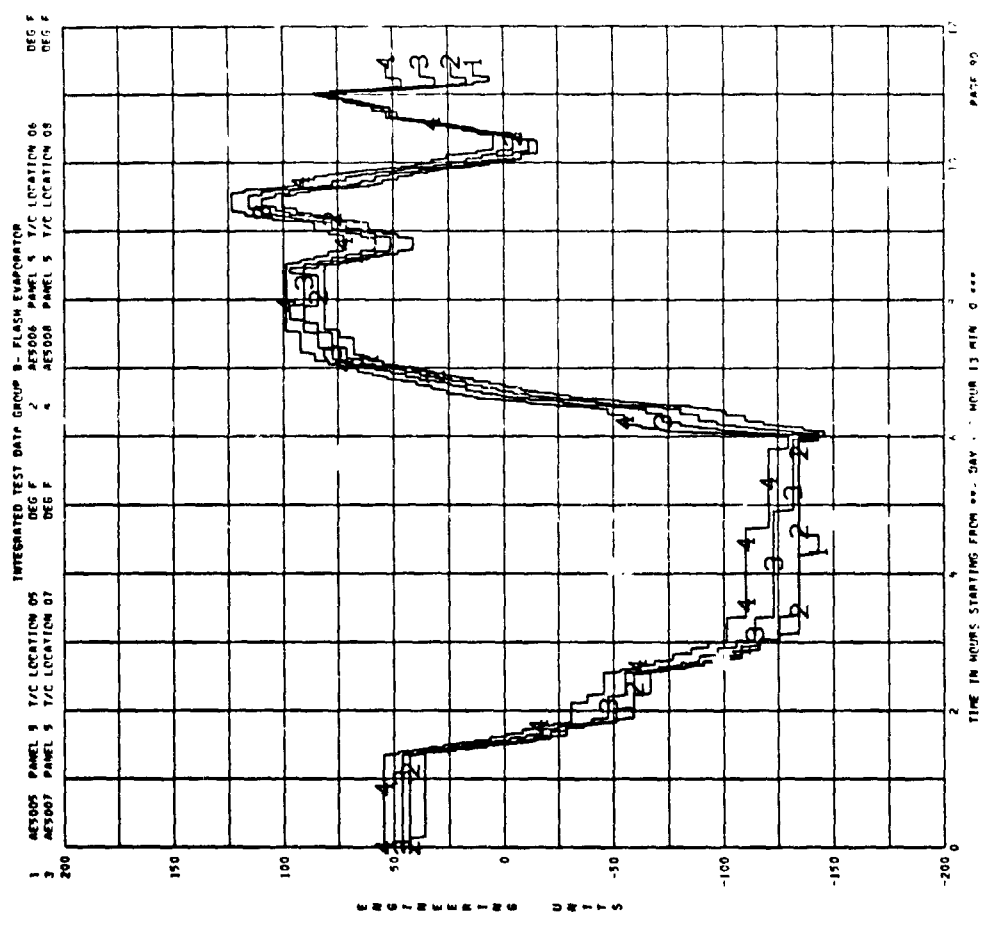
B-88



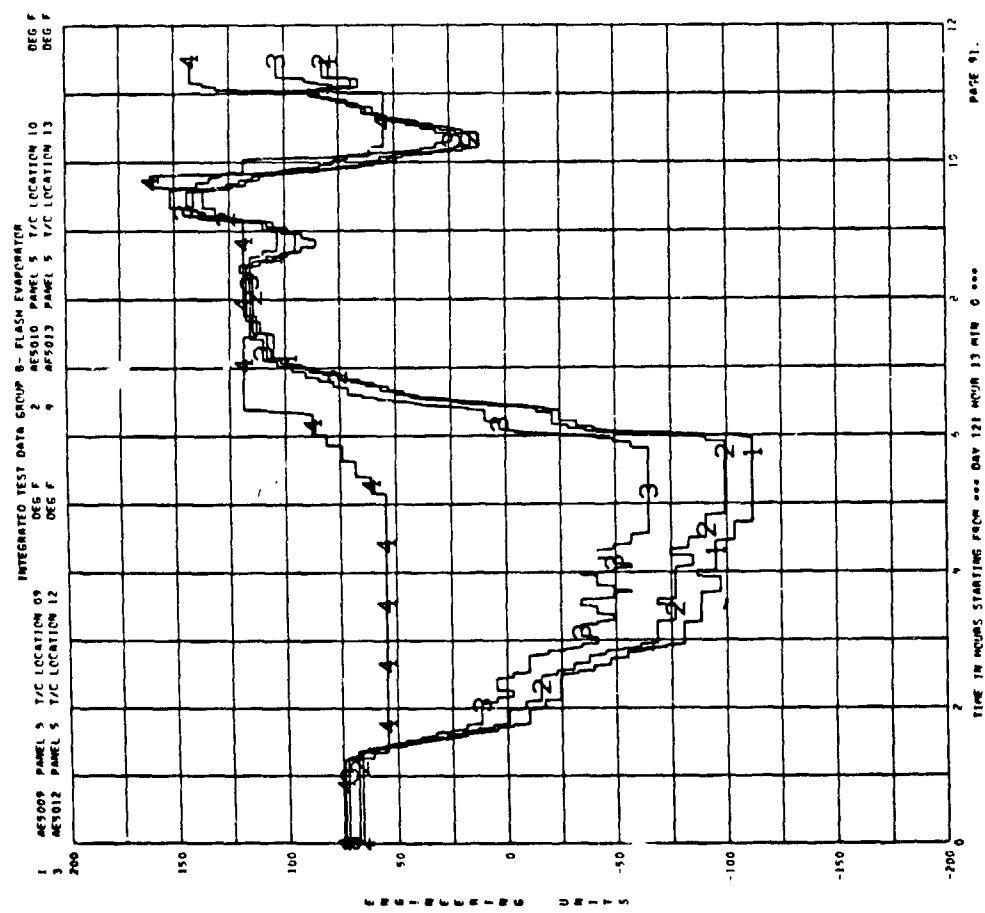
B-87



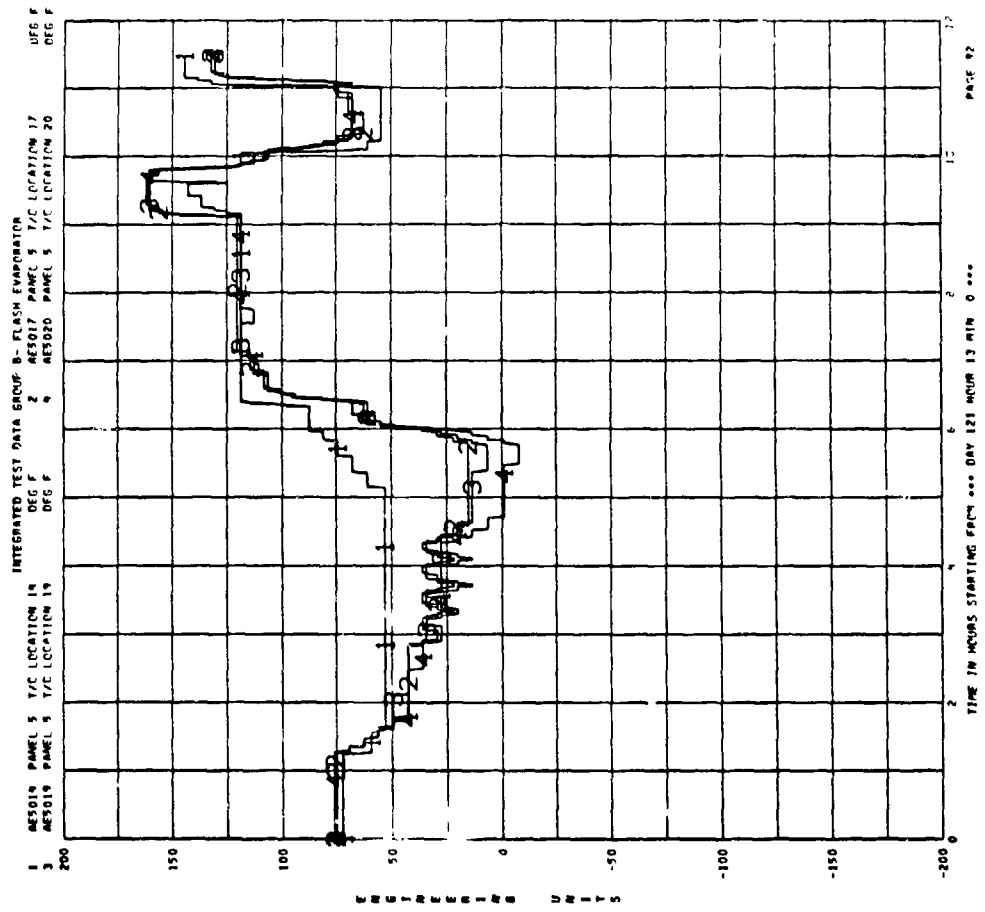
B-89



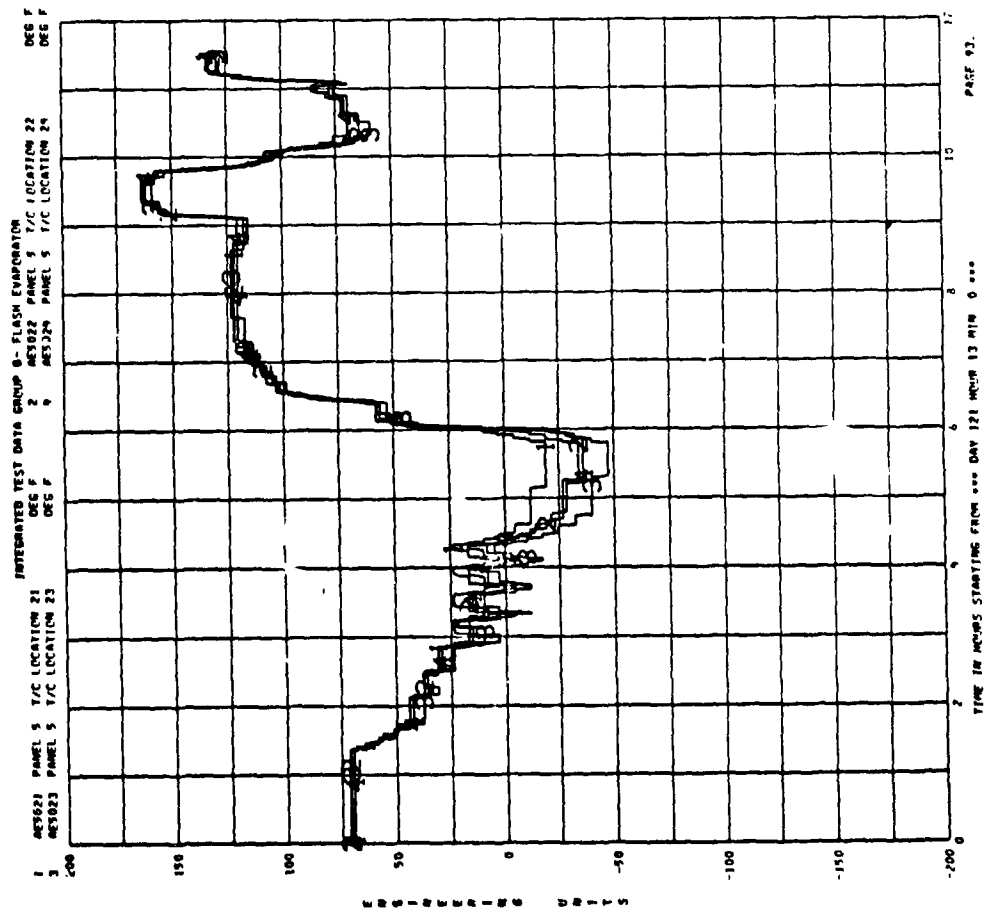
B-90



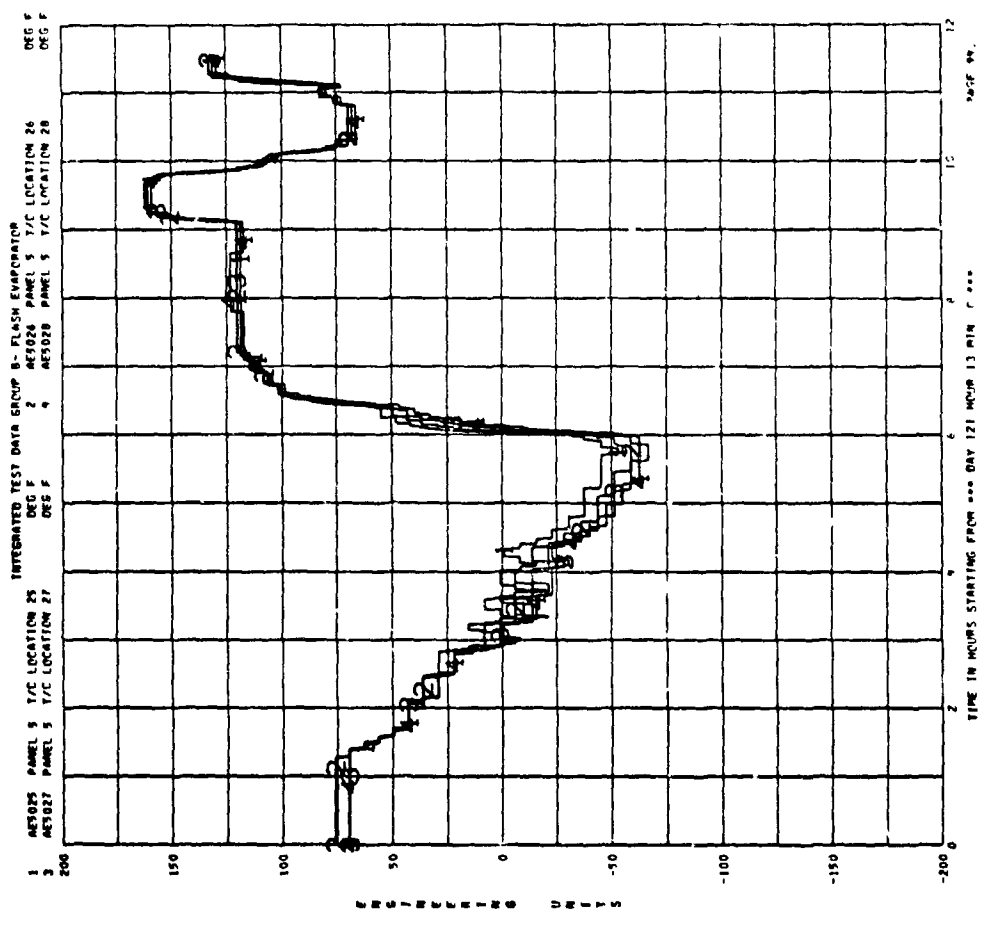
B-91



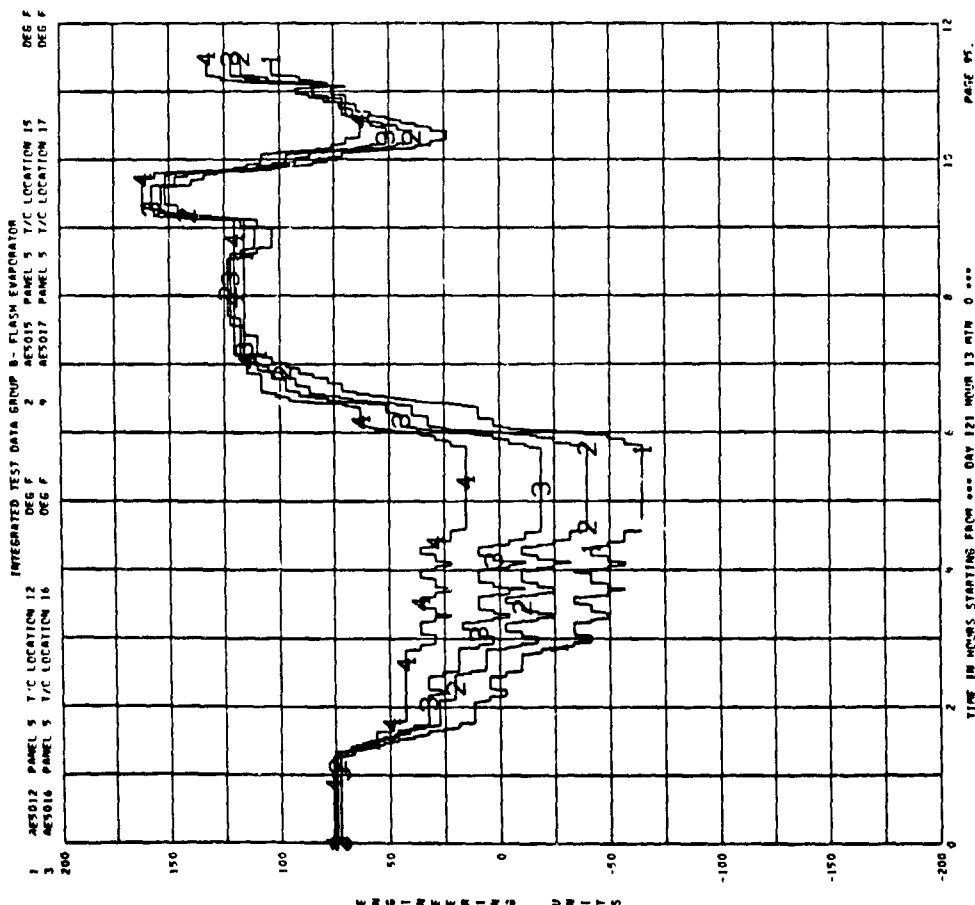
B-92



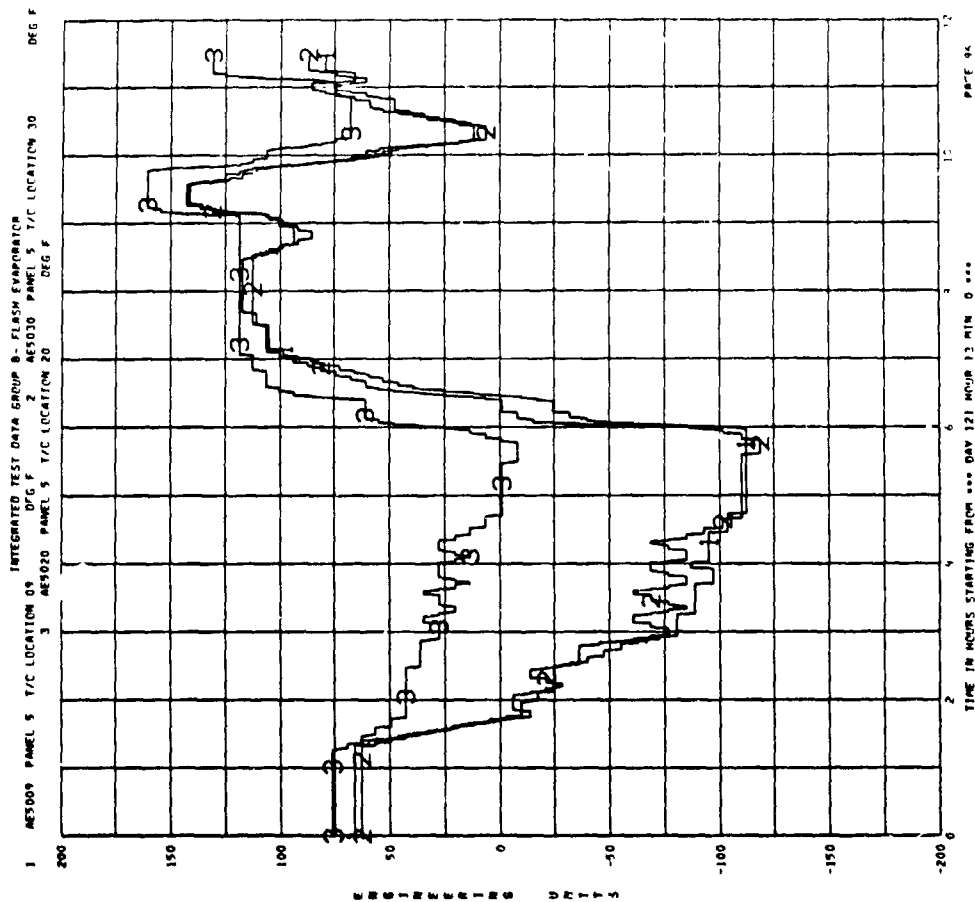
B-93



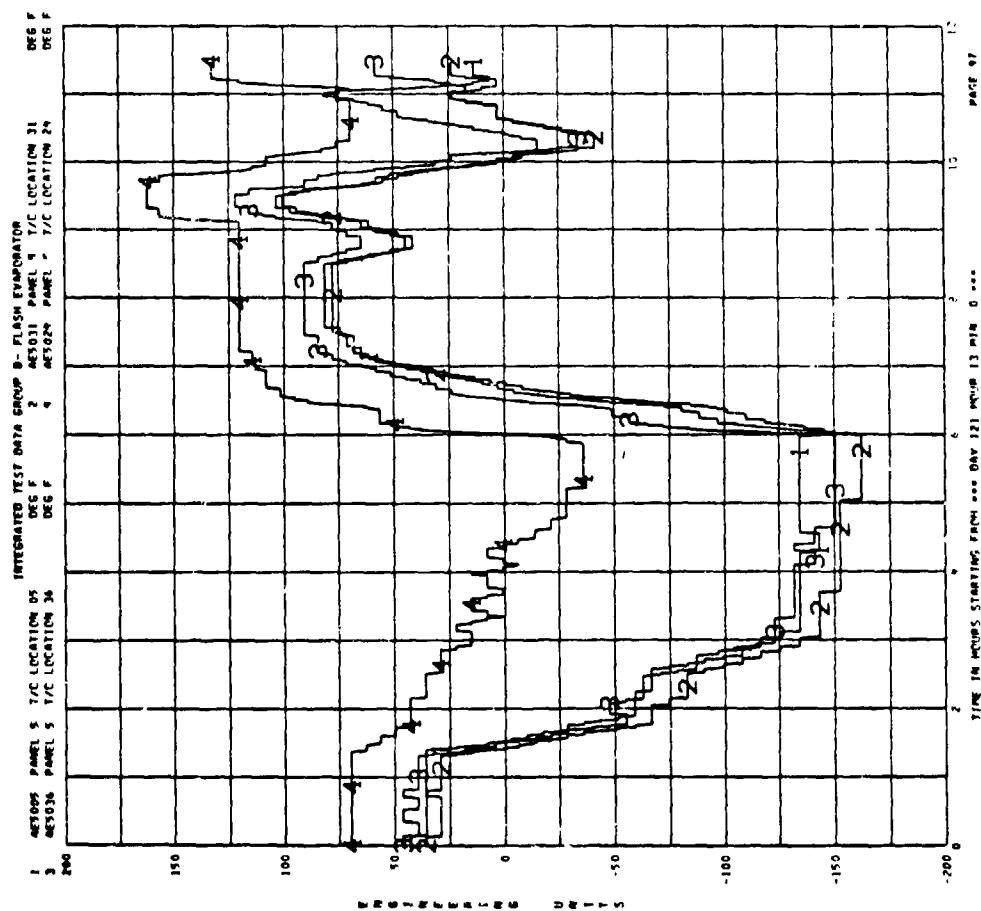
B-94



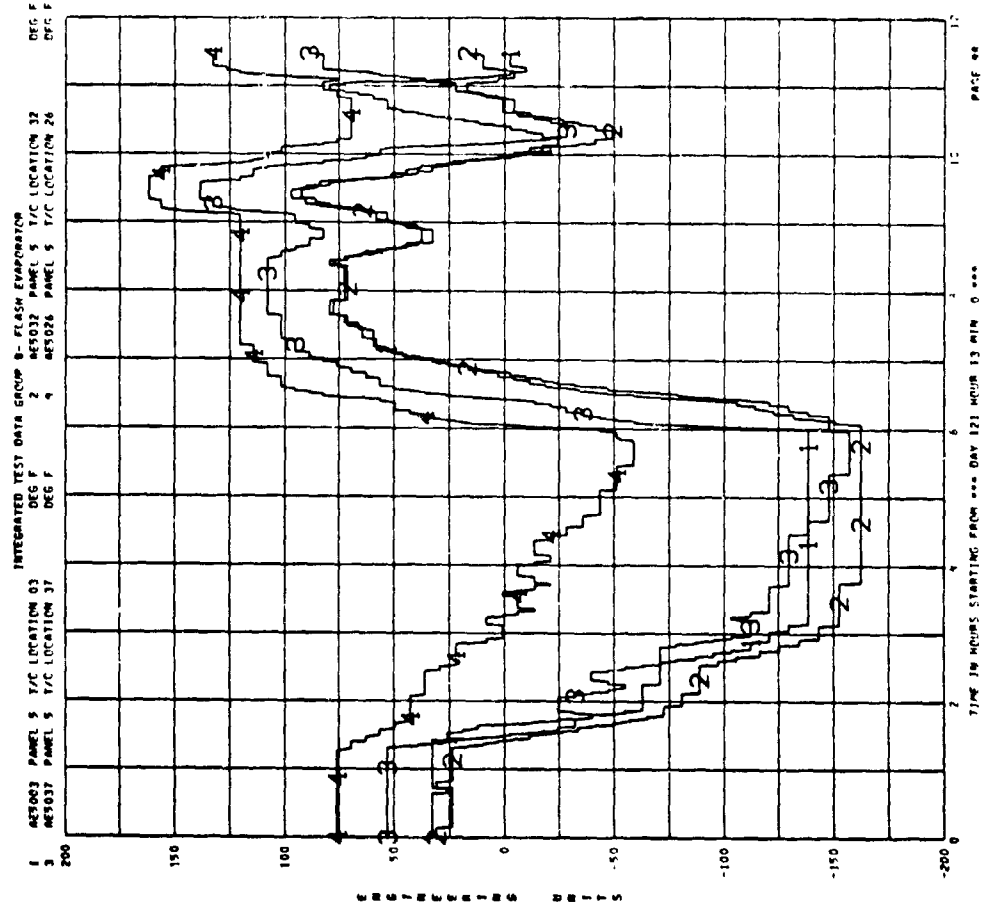
B-95



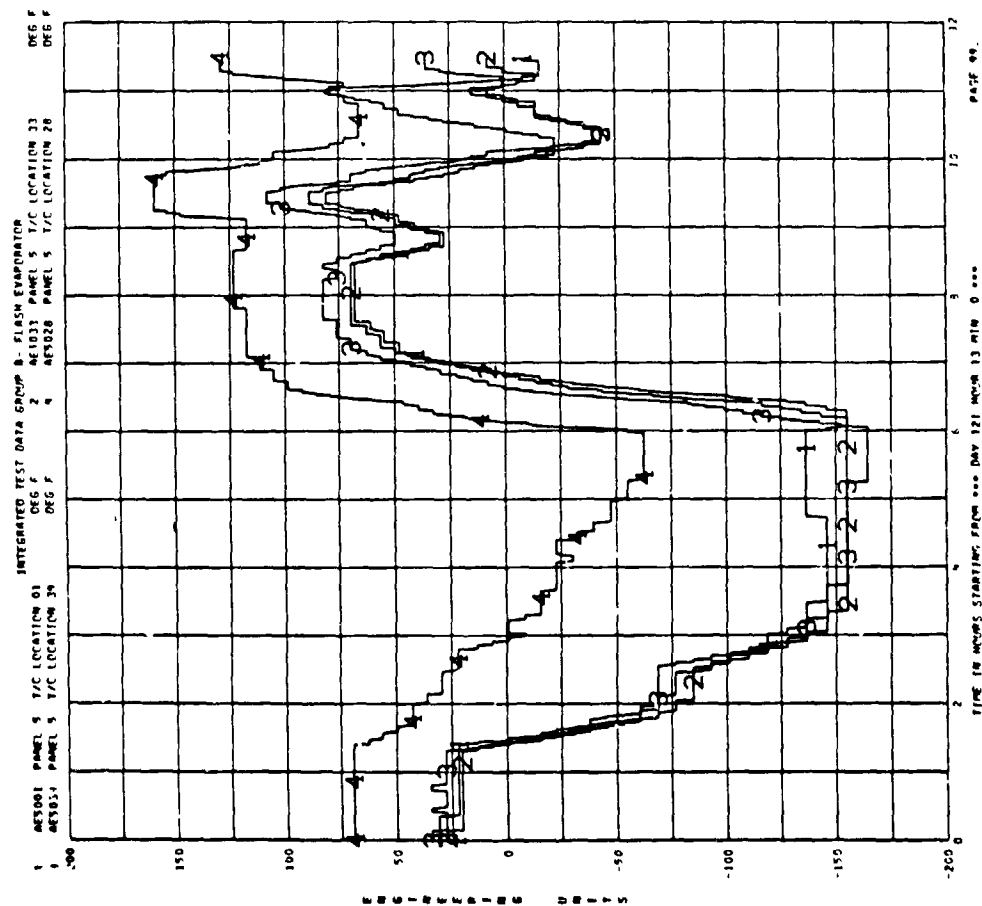
B-96



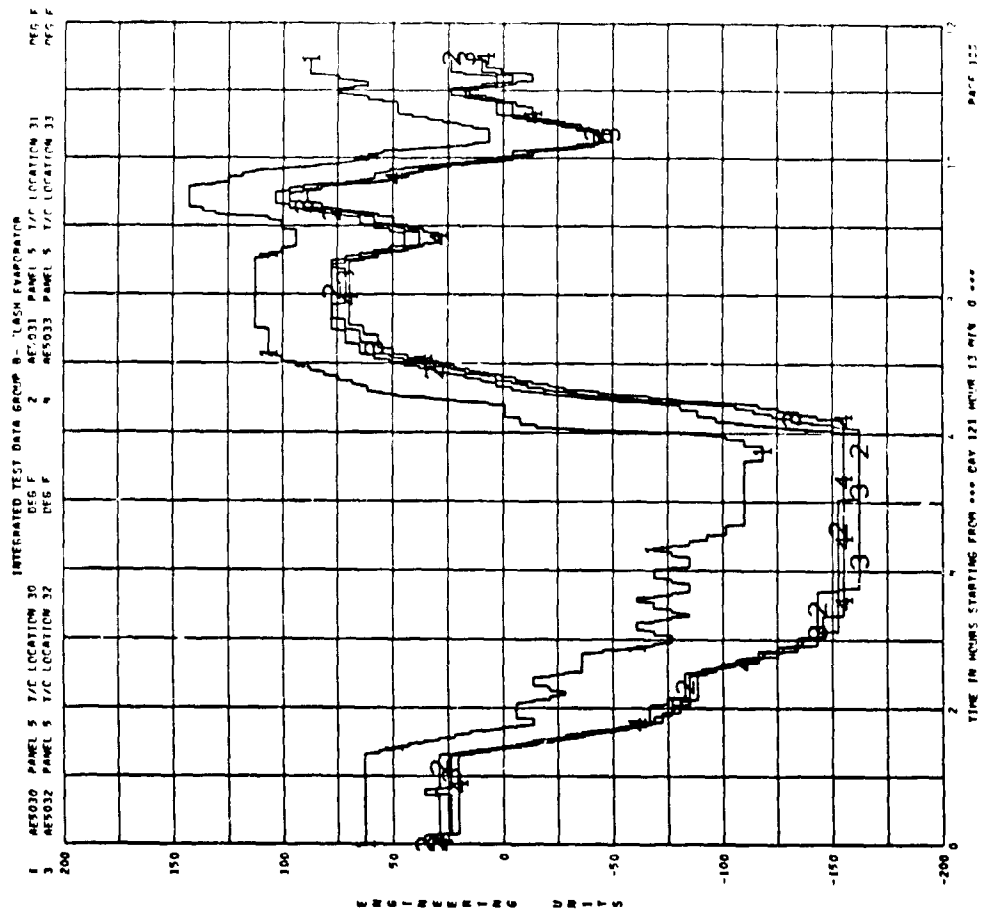
B-97



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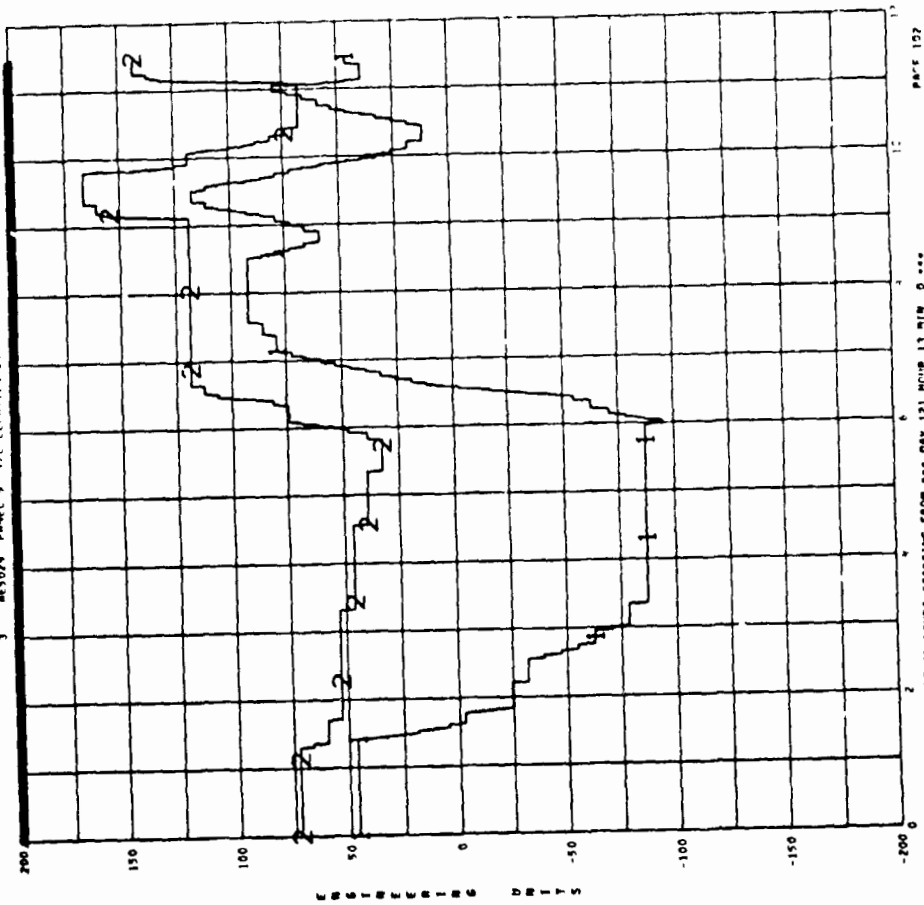


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B-100

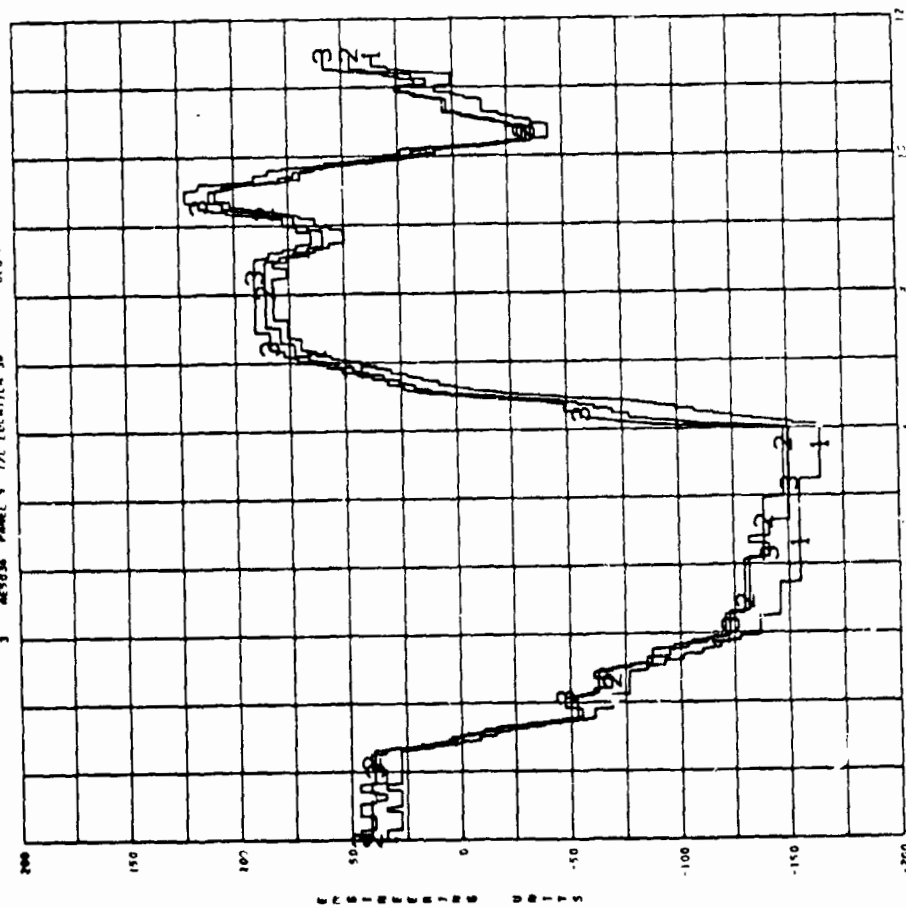
INTEGRATED TEST DATA GROUP B- FLASH EVAPORATION
 1 AFS011 PANEL 5 T/C LOCATION 11 DEG F
 2 AFS018 PANEL 5 T/C LOCATION 19 DEG F
 3 AFS029 PANEL 5 T/C LOCATION 24 DEG F



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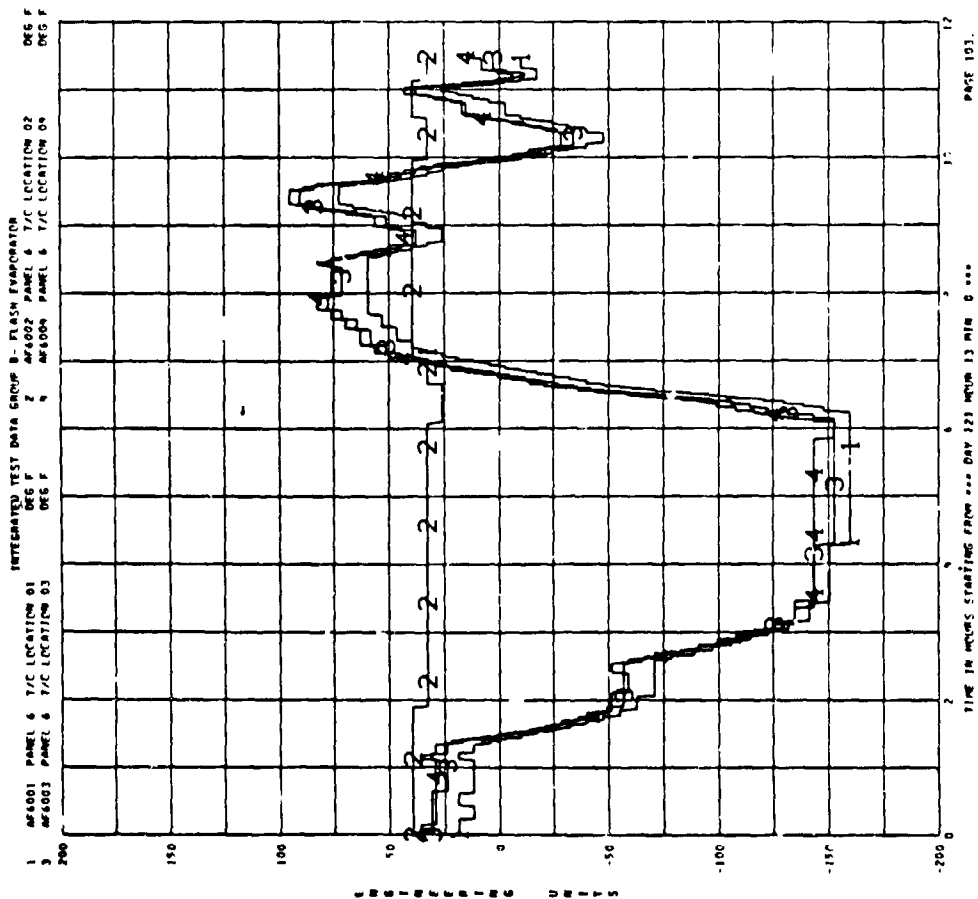
B-102

INTEGRATED TEST DATA GROUP B- FLASH EVAPORATION
 1 AFS039 PANEL 5 T/C LOCATION 34 DEG F
 2 AFS035 PANEL 5 T/C LOCATION 35 DEG F
 3 AFS034 PANEL 5 T/C LOCATION 36 DEG F

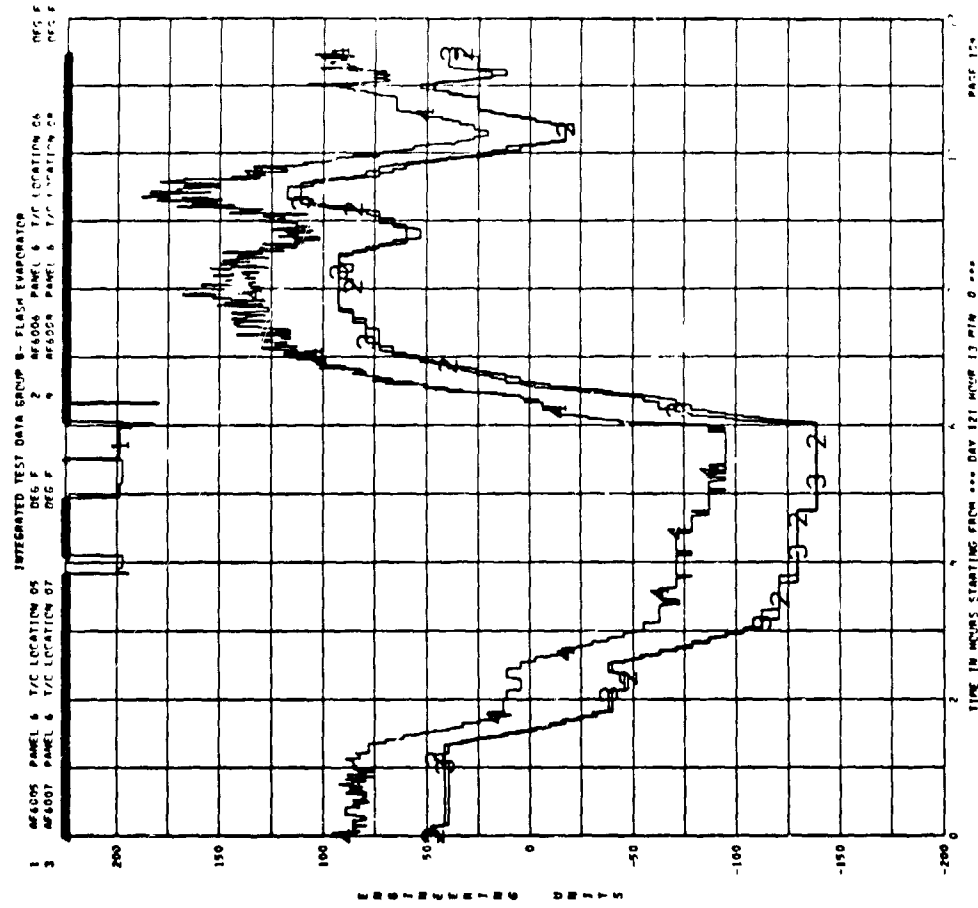


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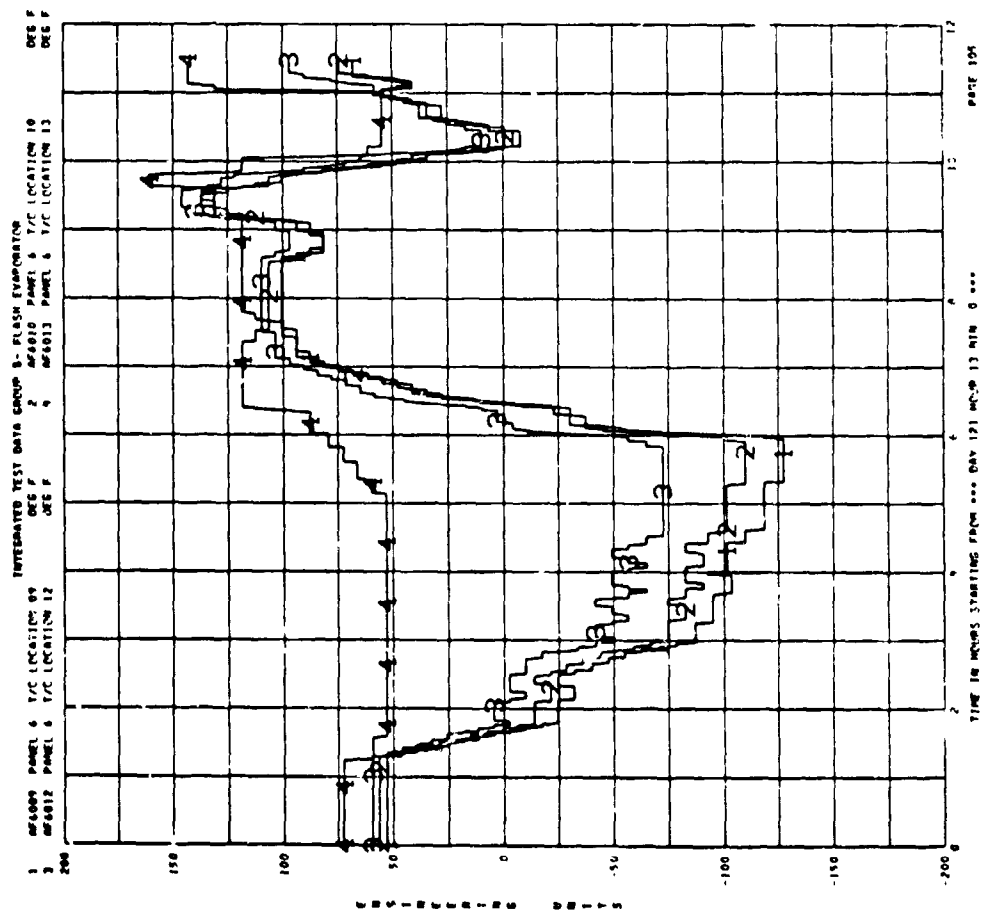
B-101



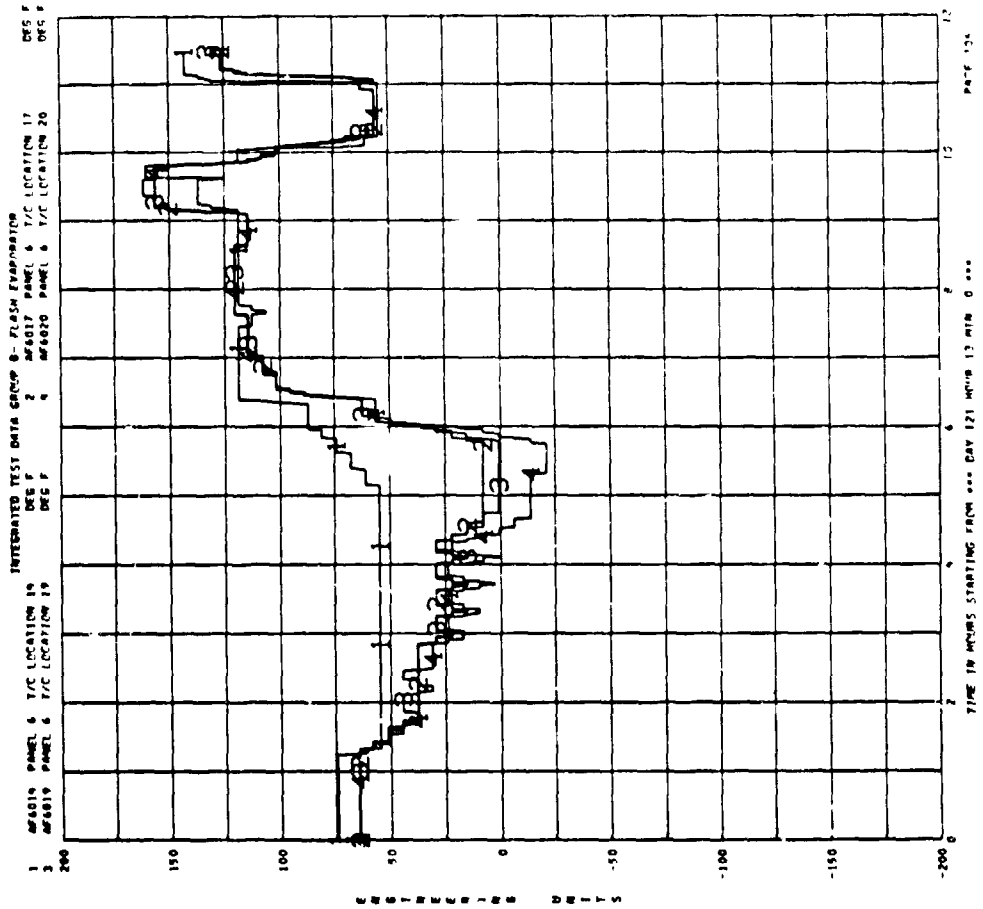
B-103



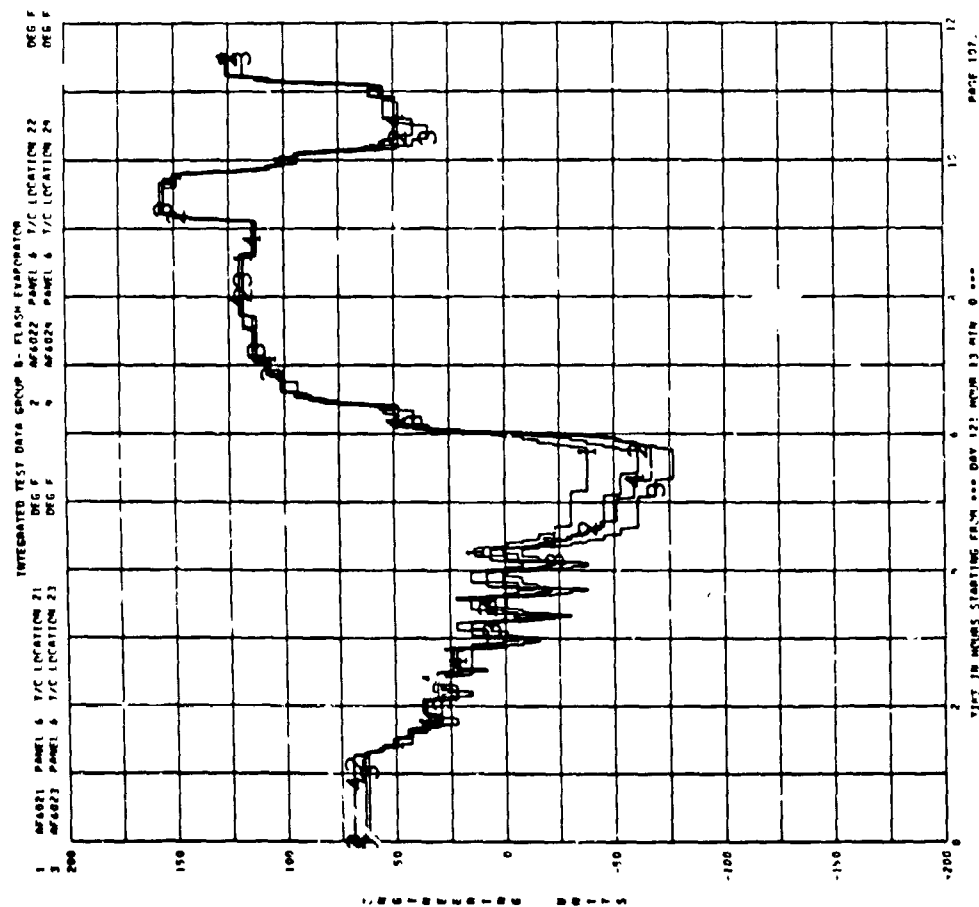
B-104



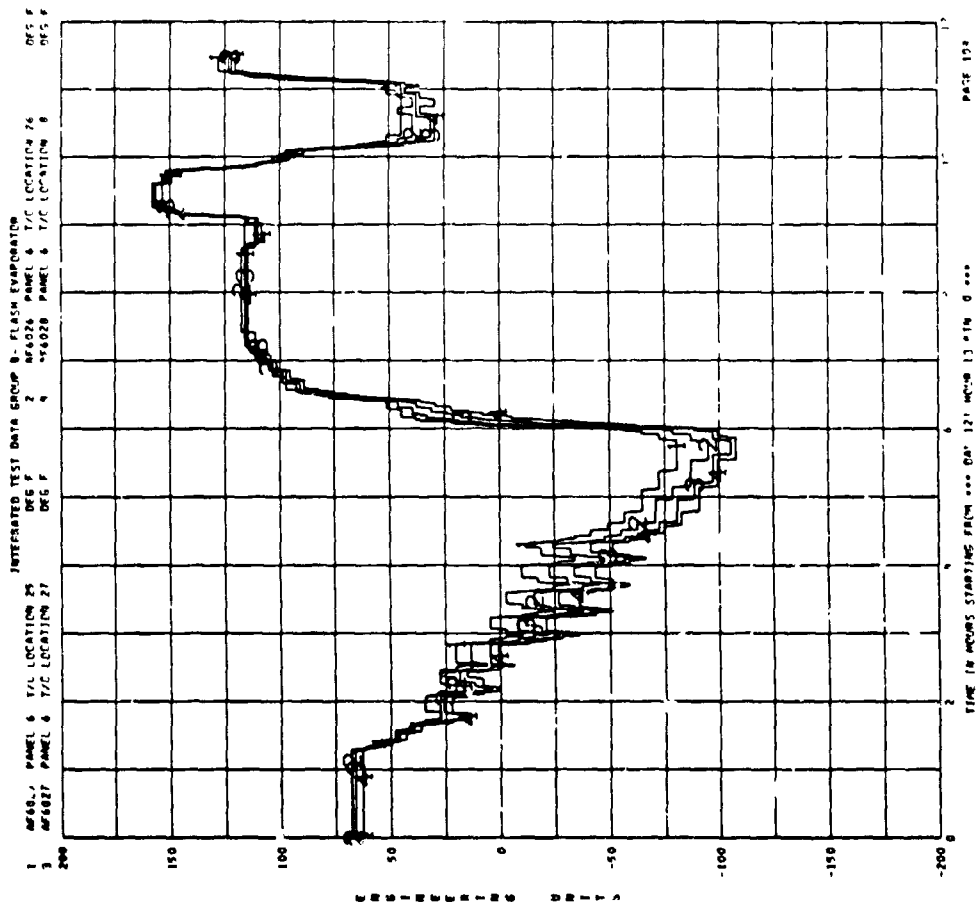
B-105



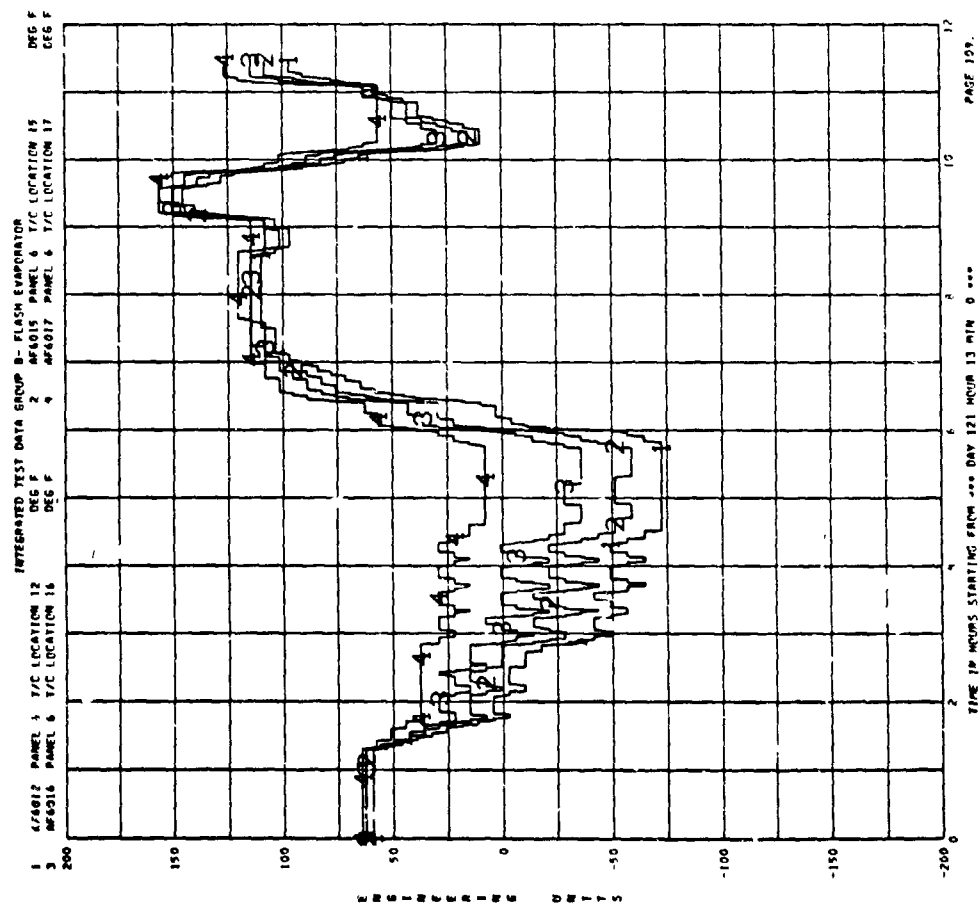
B-106



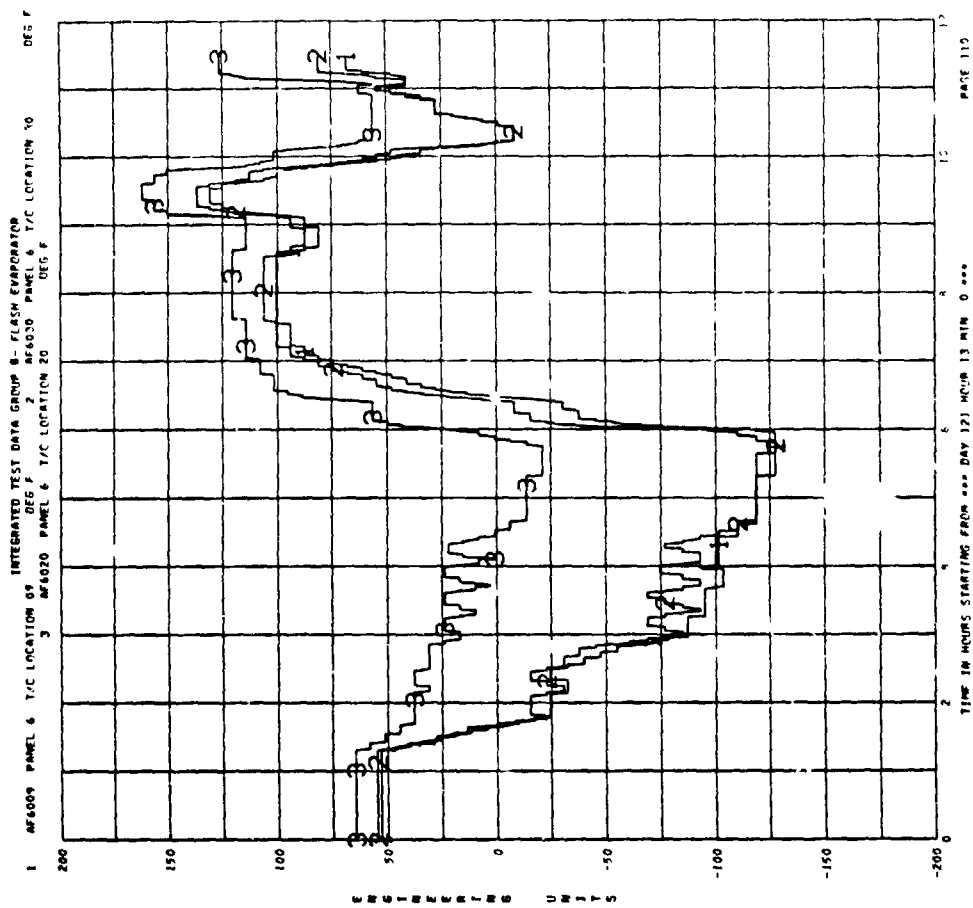
B-107



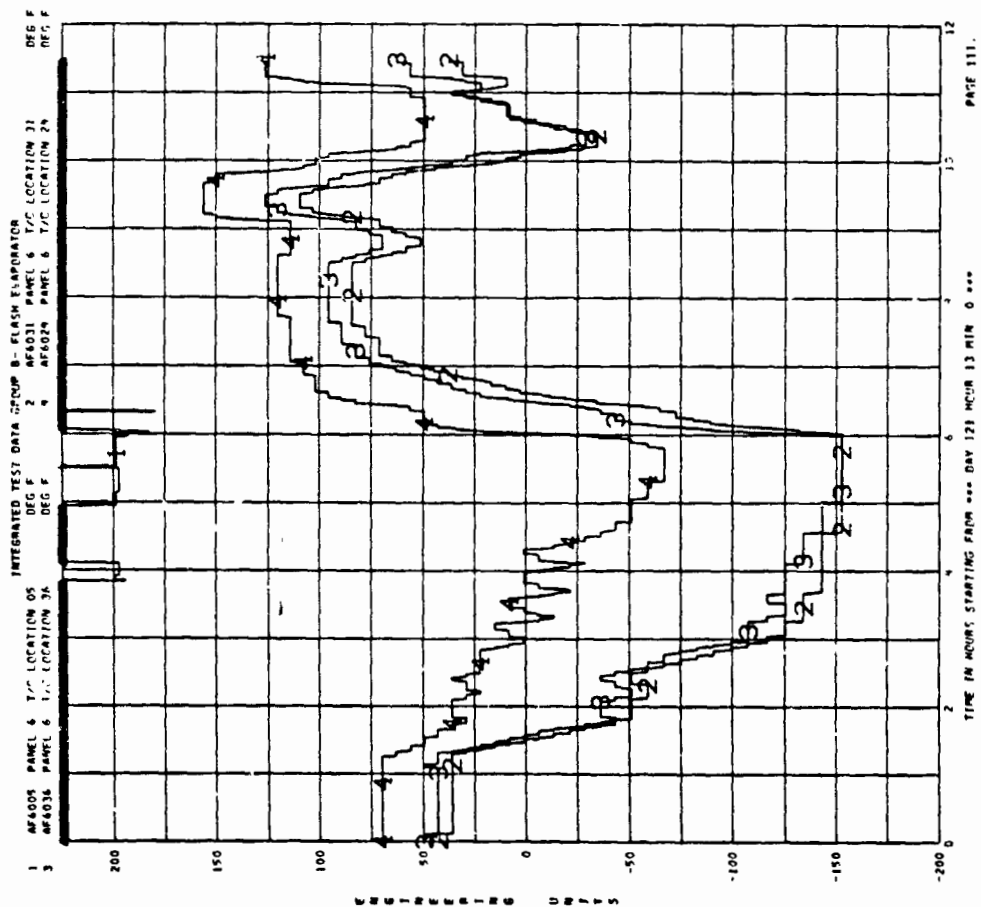
B-108



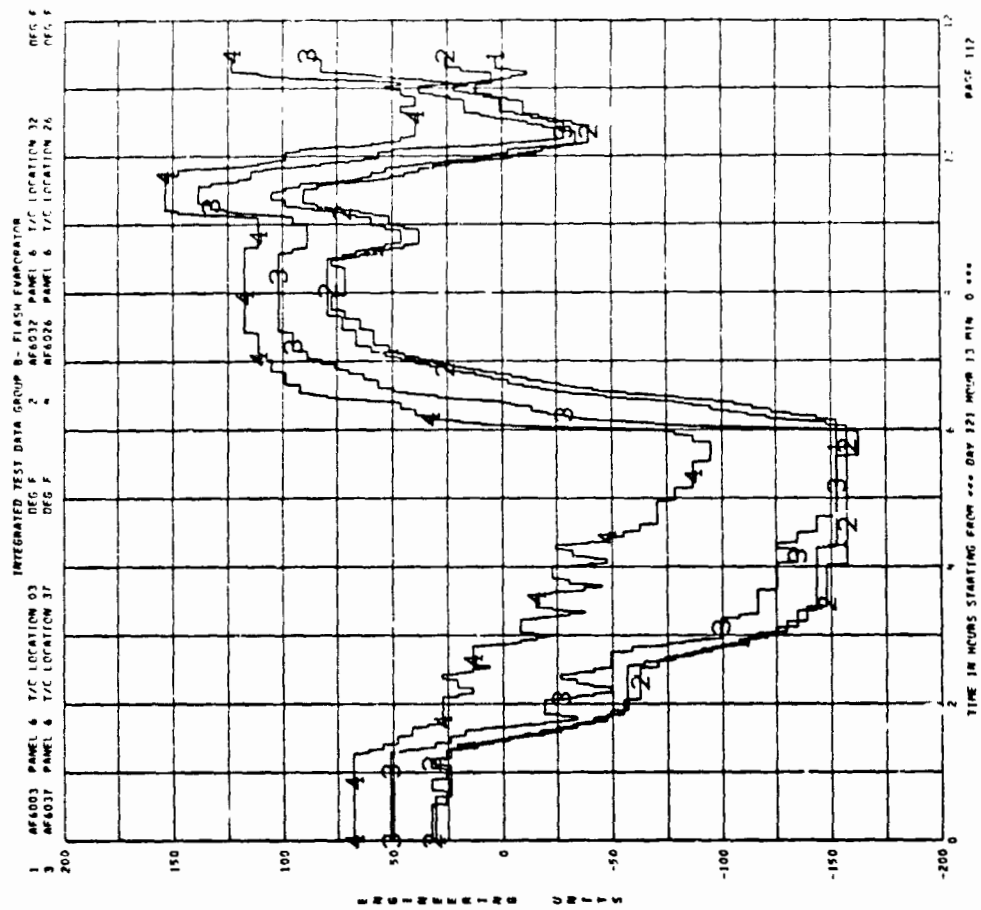
B-109



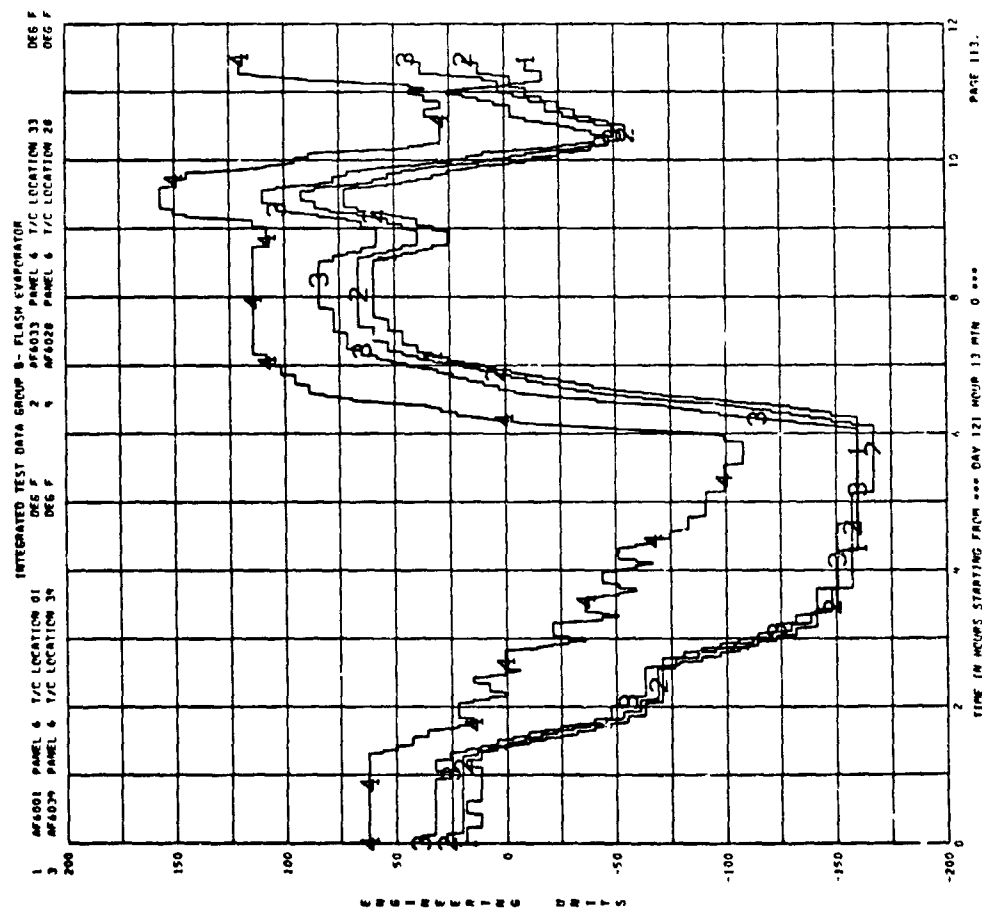
B-110



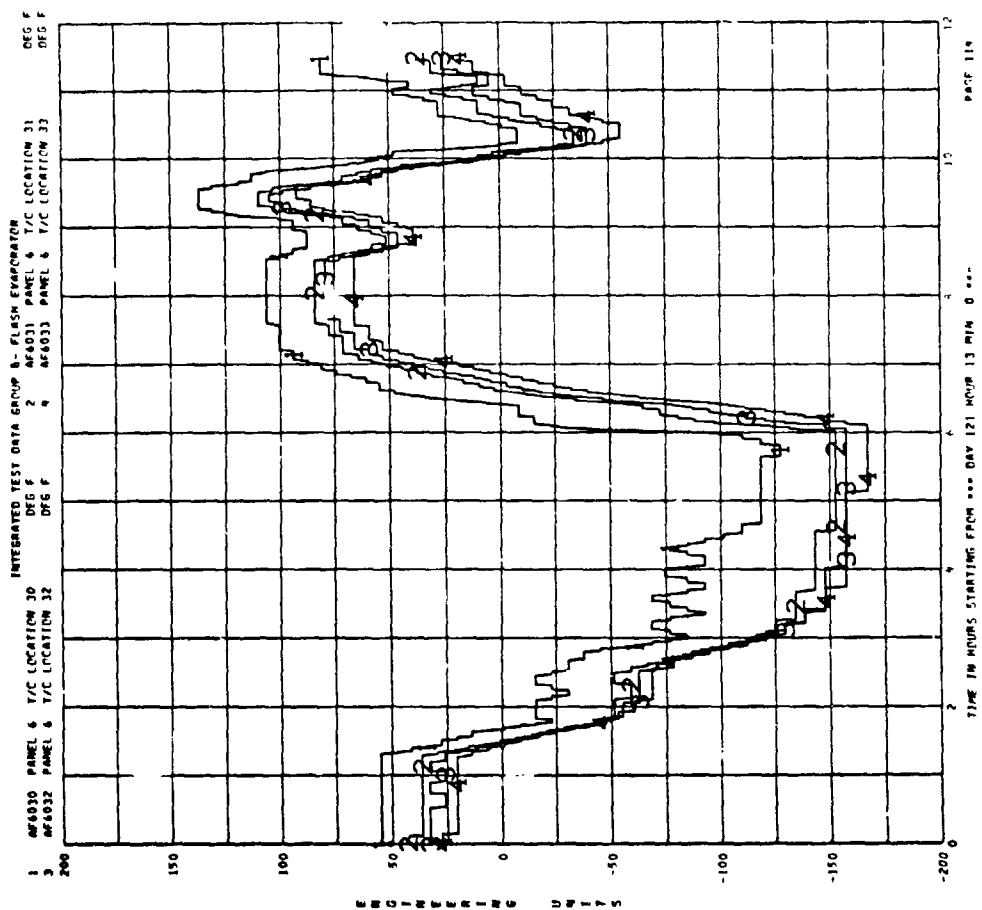
B-III



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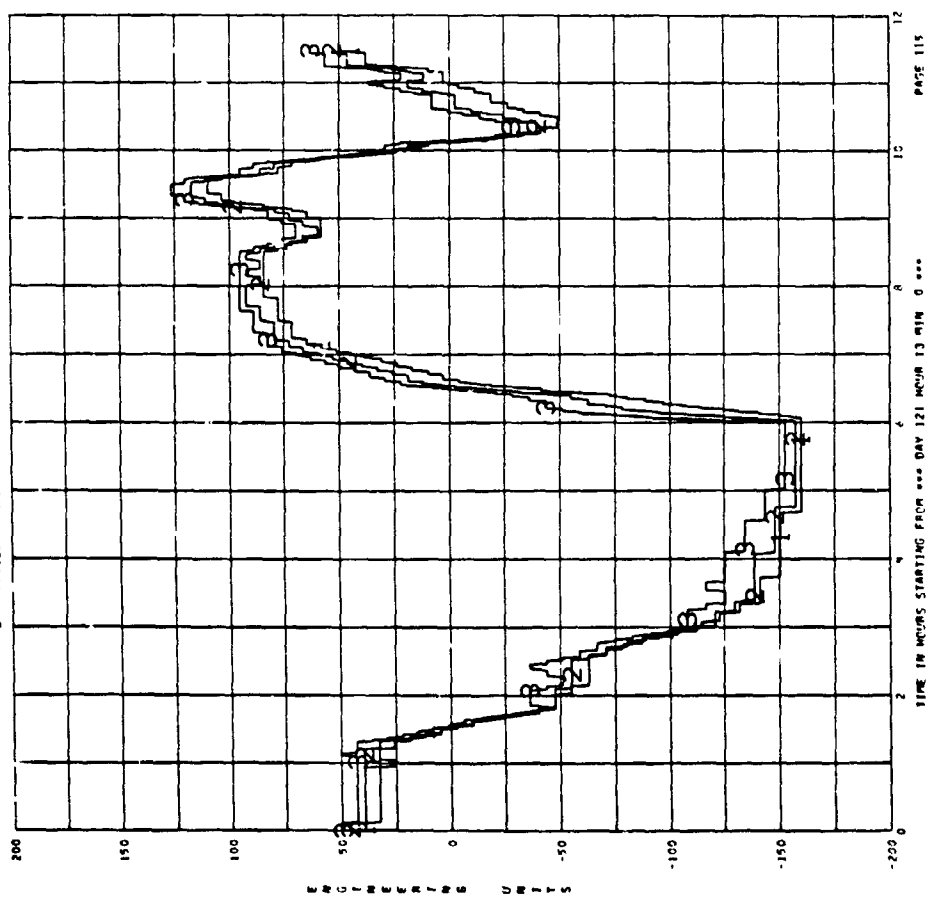


B-113



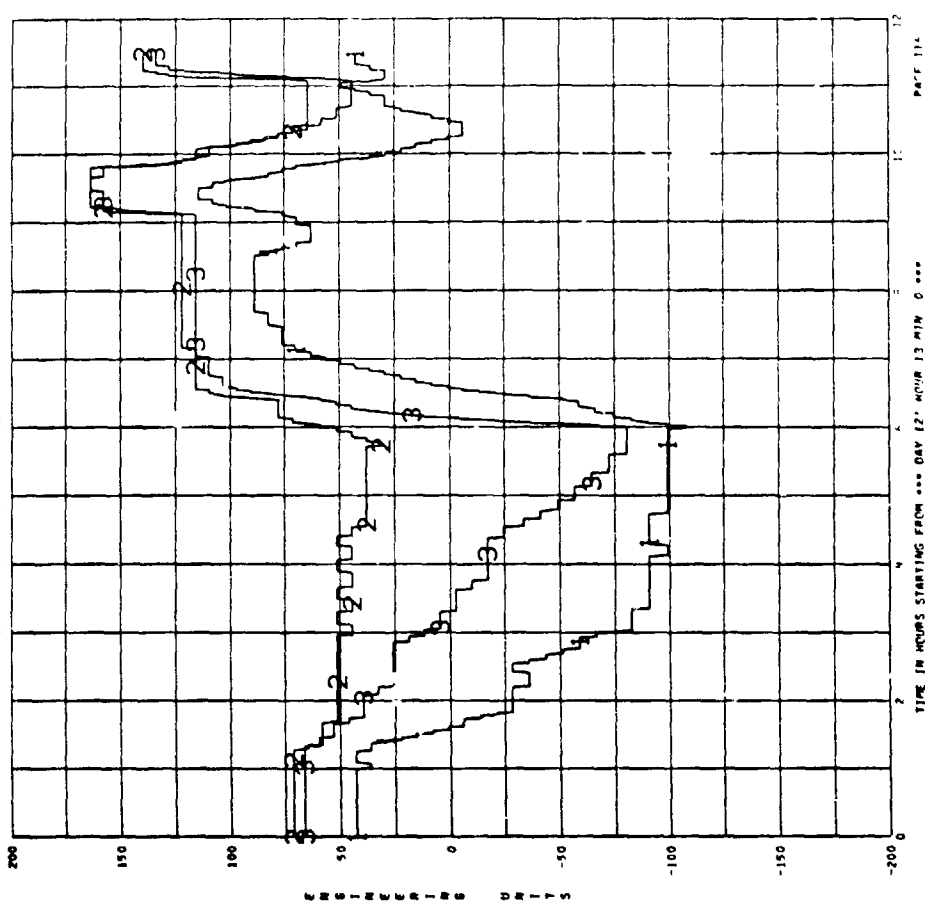
B-114

1 AF603N PANEL 6 T/C LOCATION 29 DEG F
 2 AF603N PANEL 6 T/C LOCATION 36 DEG F
 3 AF603N PANEL 6 T/C LOCATION 35 DEG F

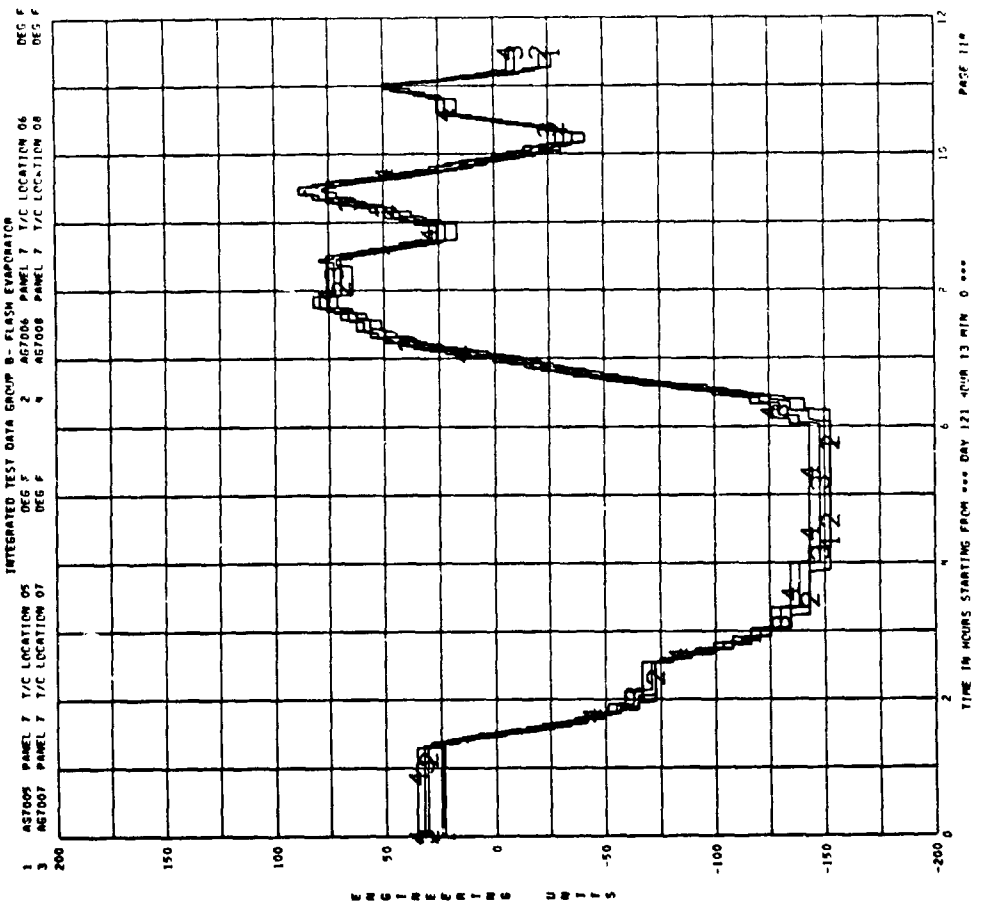


B-115

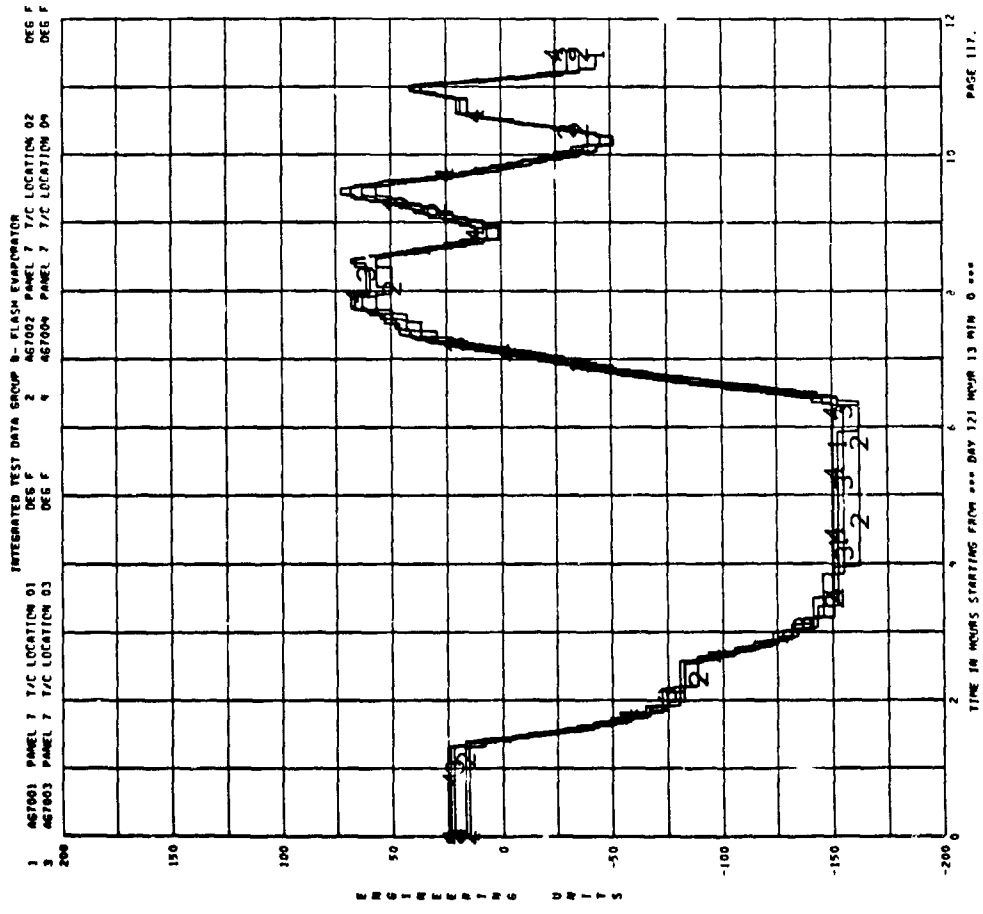
1 AF6011 PANEL 6 T/C LOCATION 11 DEG F
 2 AF6029 PANEL 6 T/C LOCATION 29 DEG F
 3 AF6029 PANEL 6 T/C LOCATION 29 DEG F



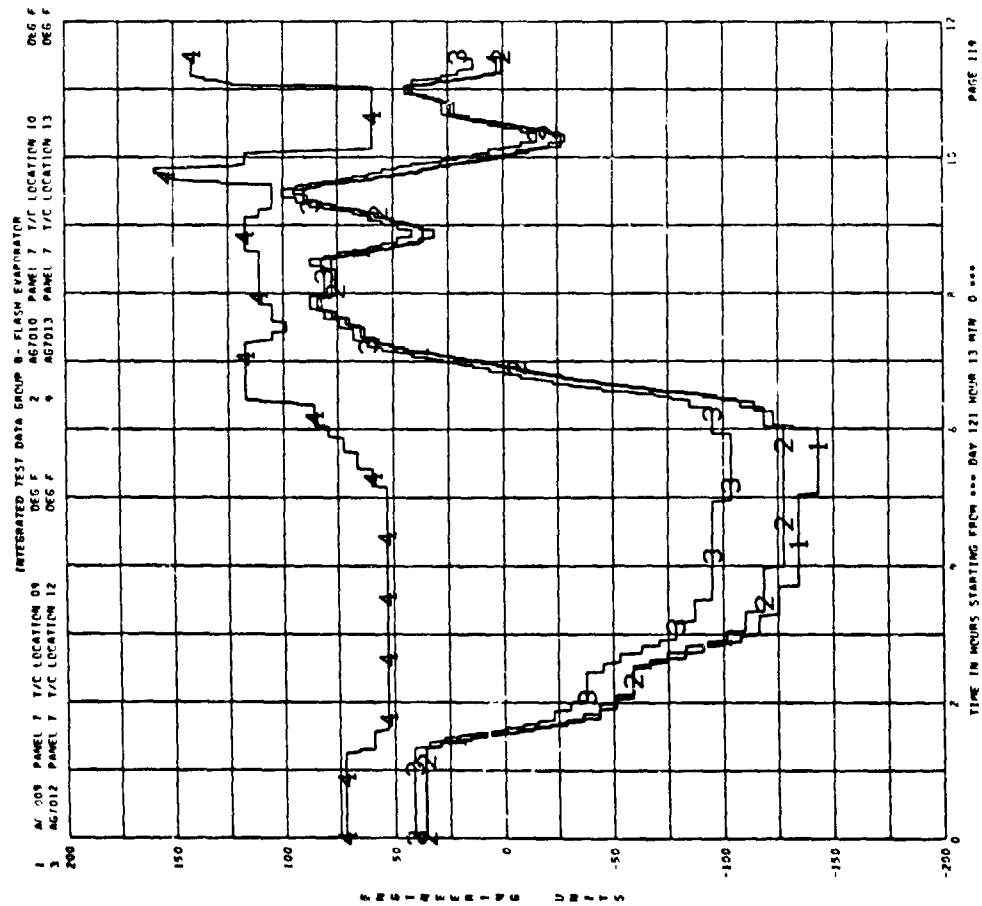
B-116



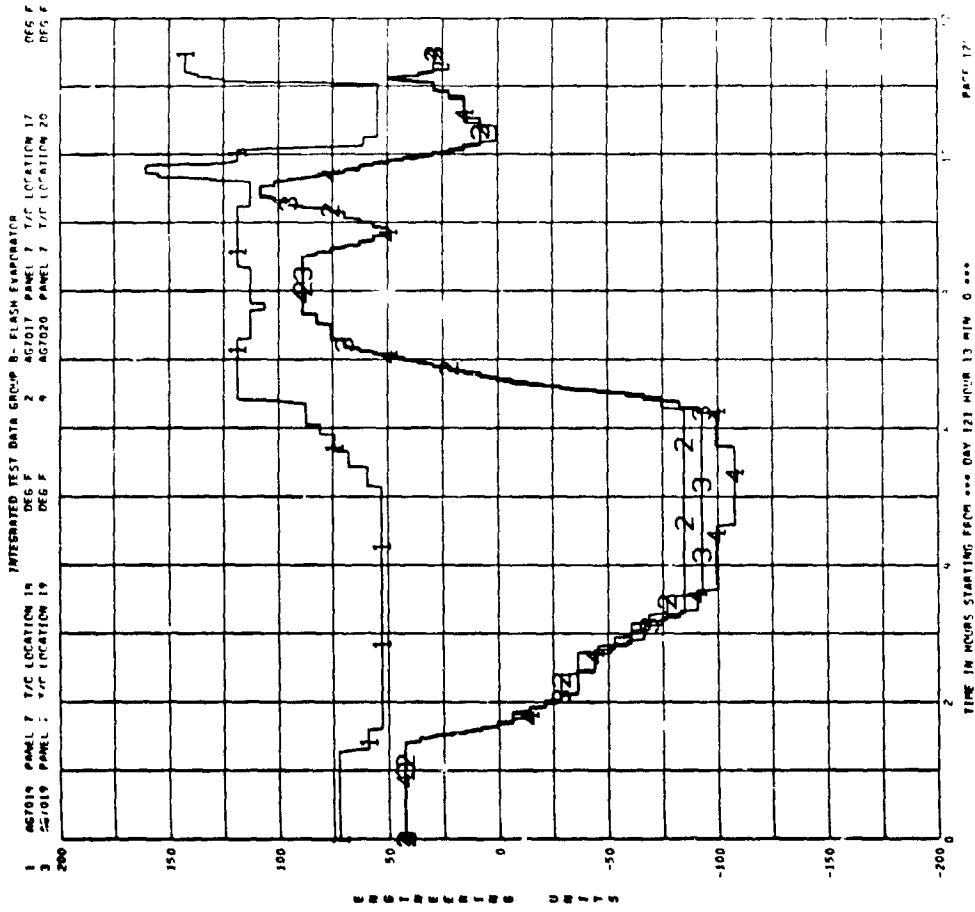
B-118



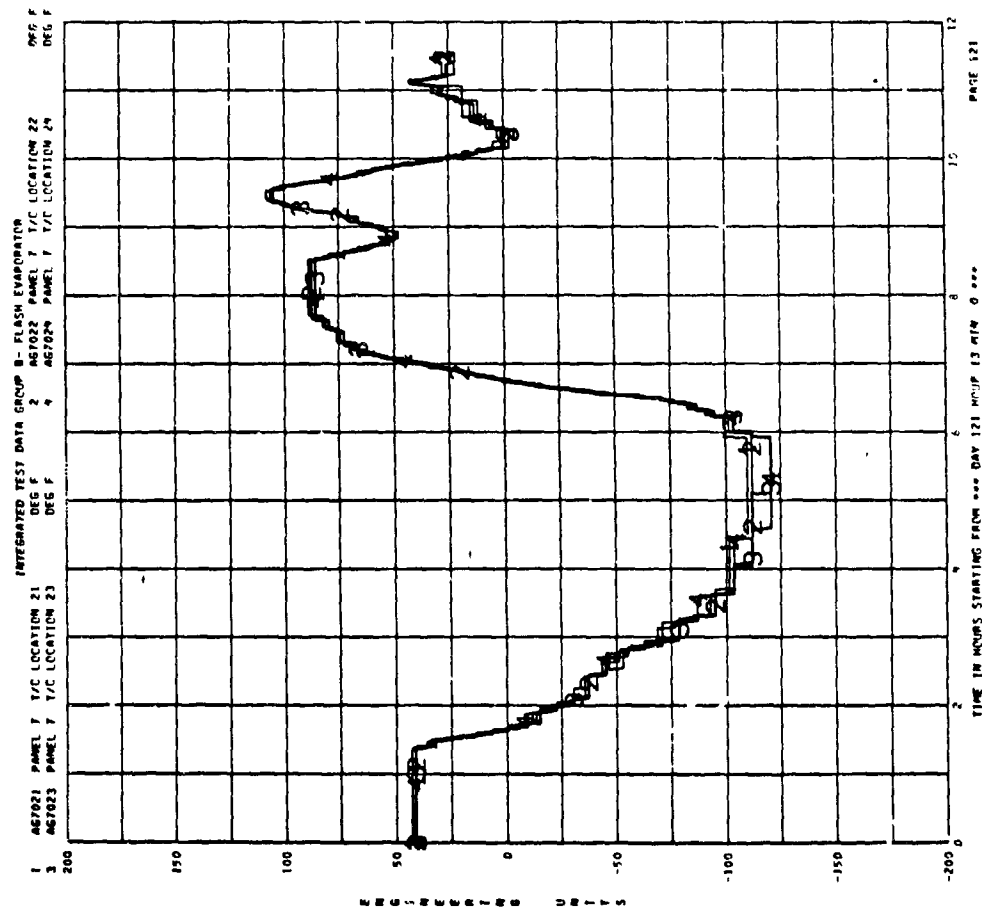
B-117



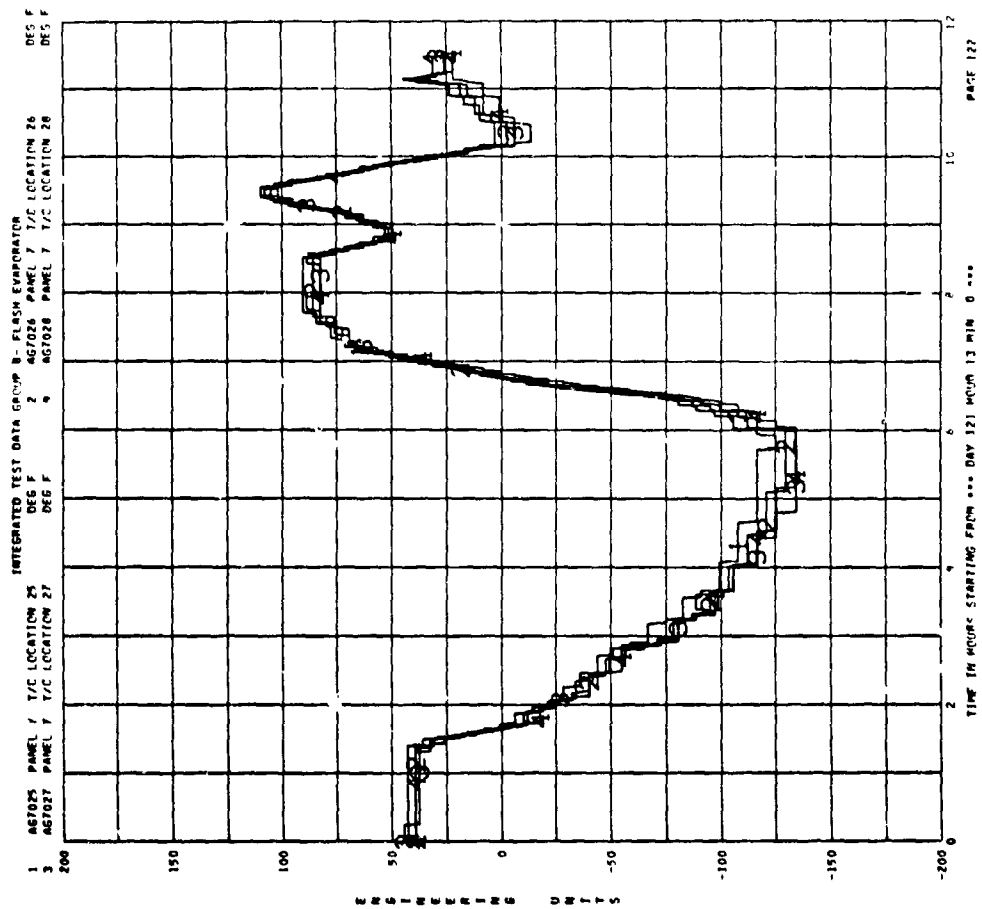
B-119



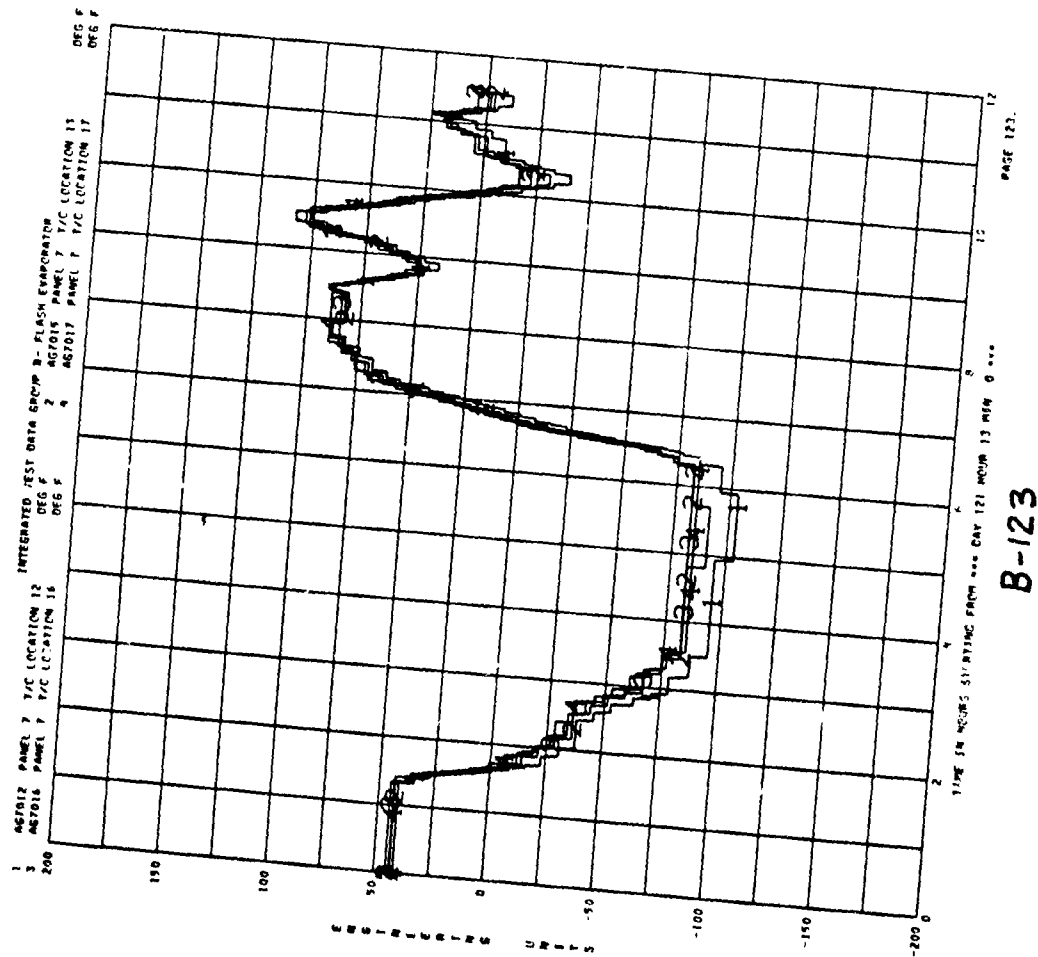
B-120



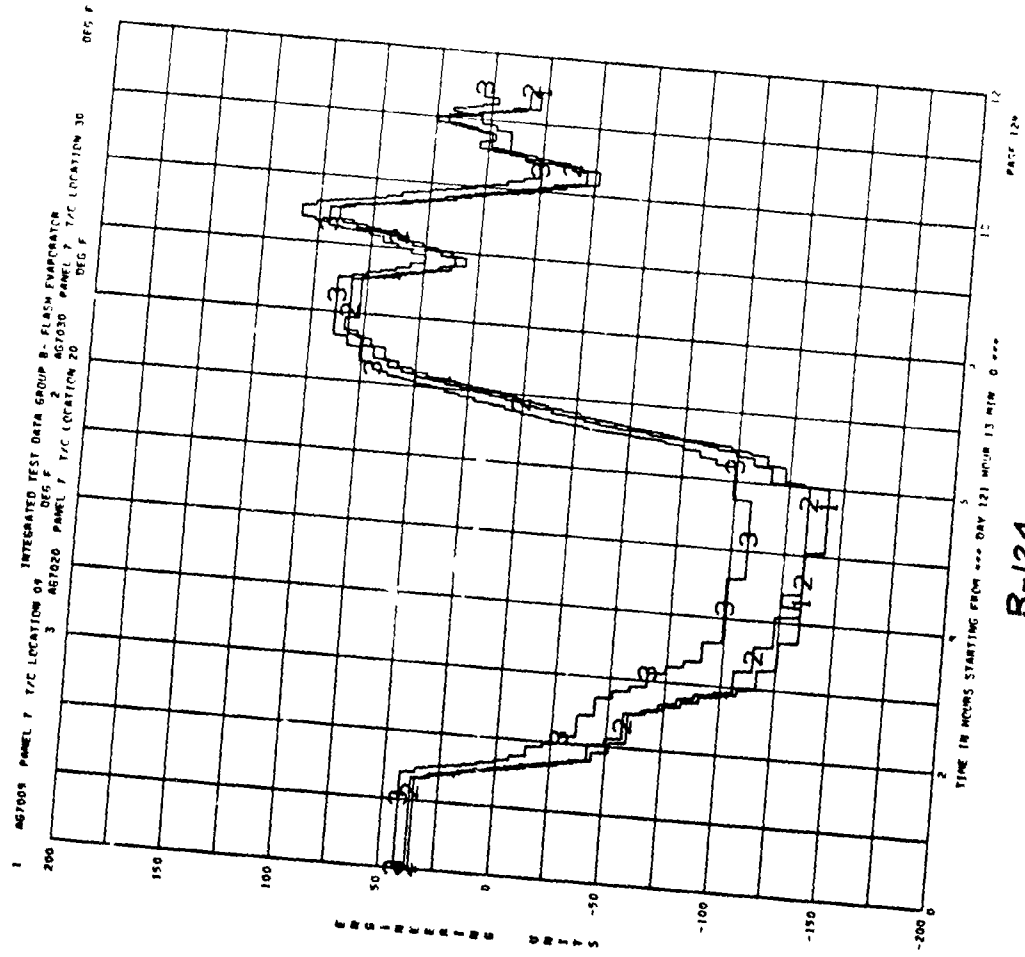
B-121



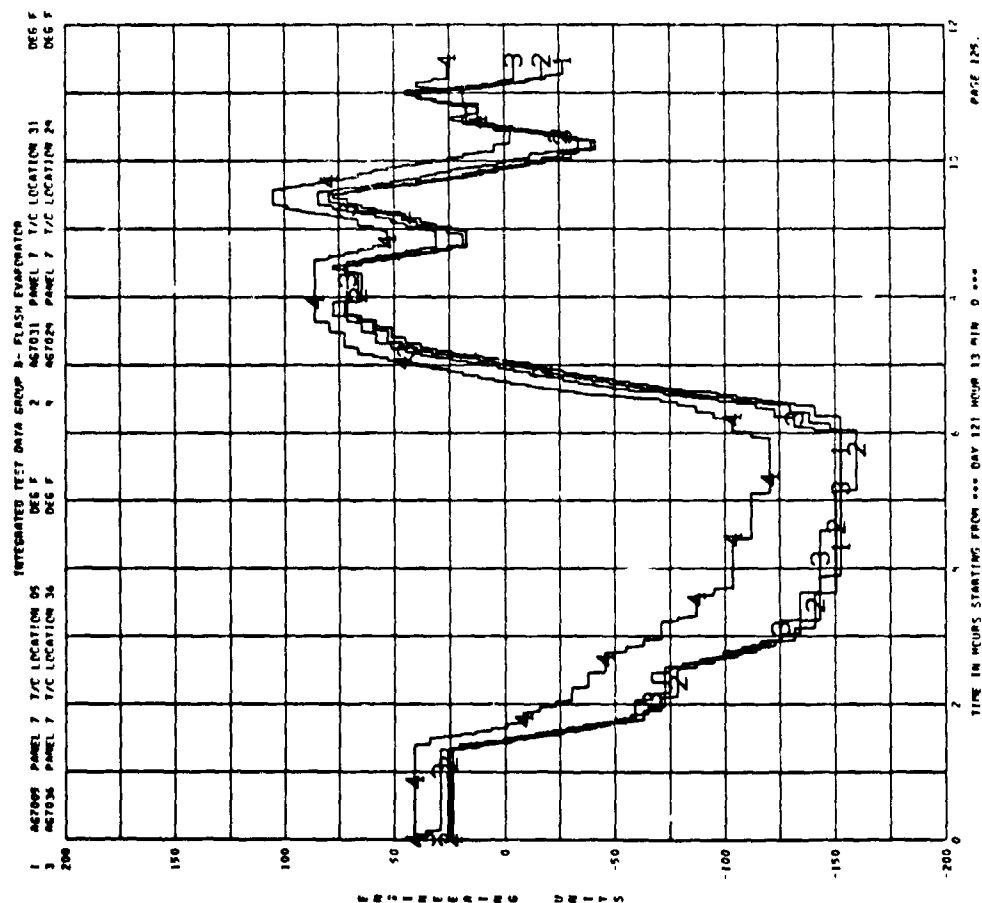
B-122



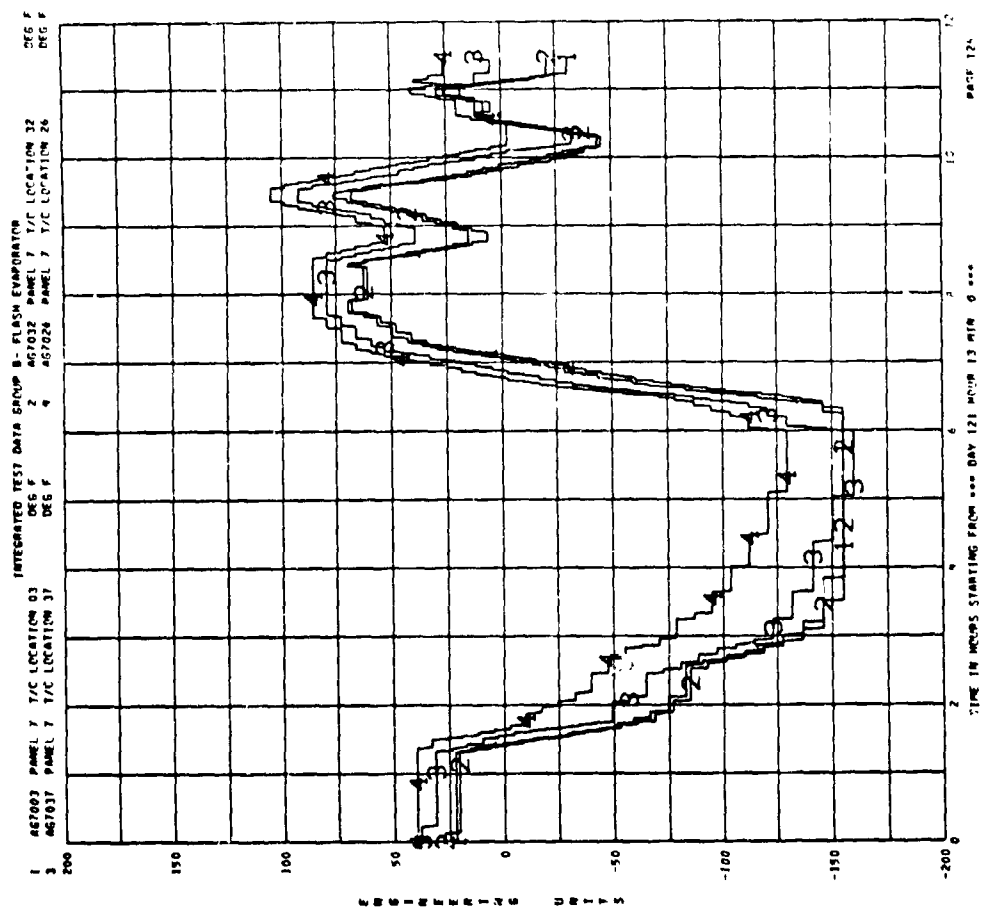
B-123



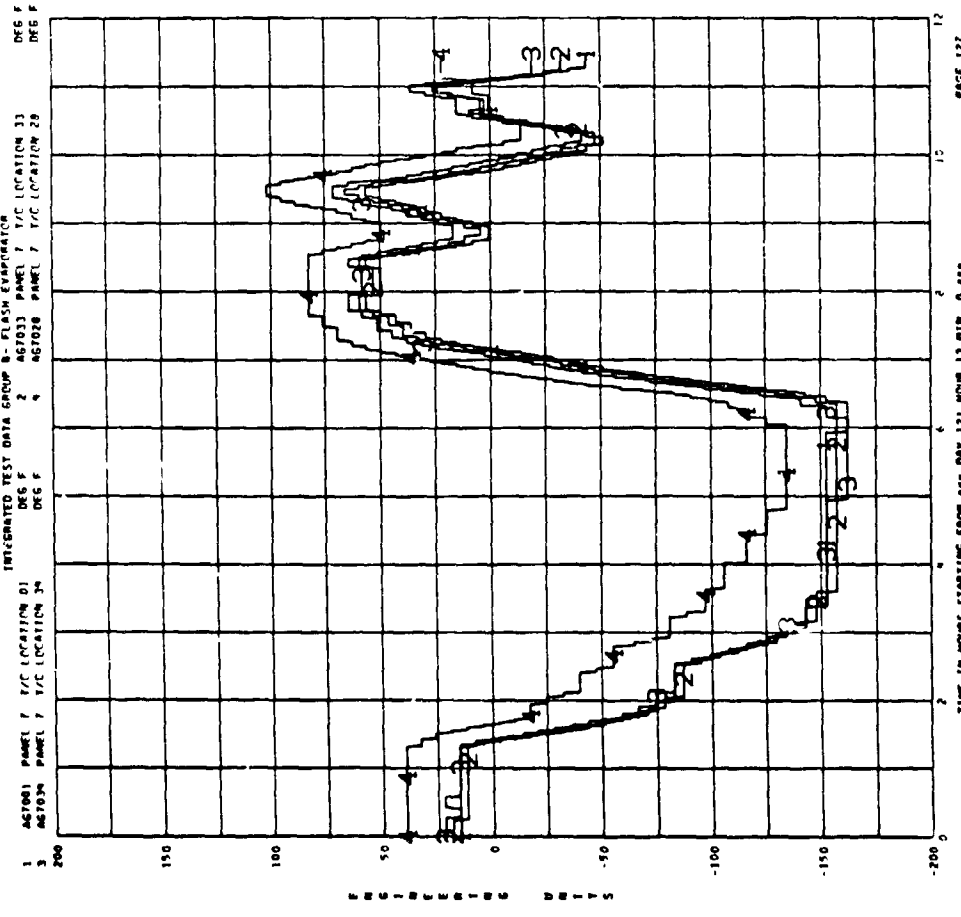
B-124



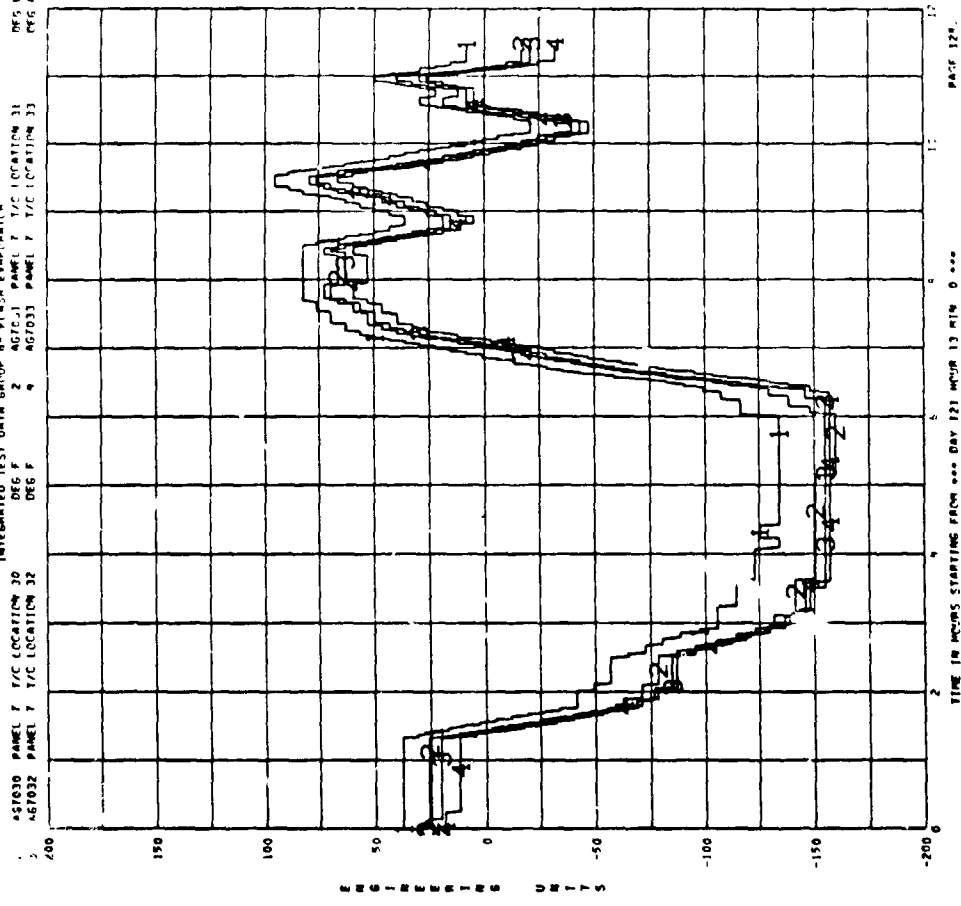
B-125



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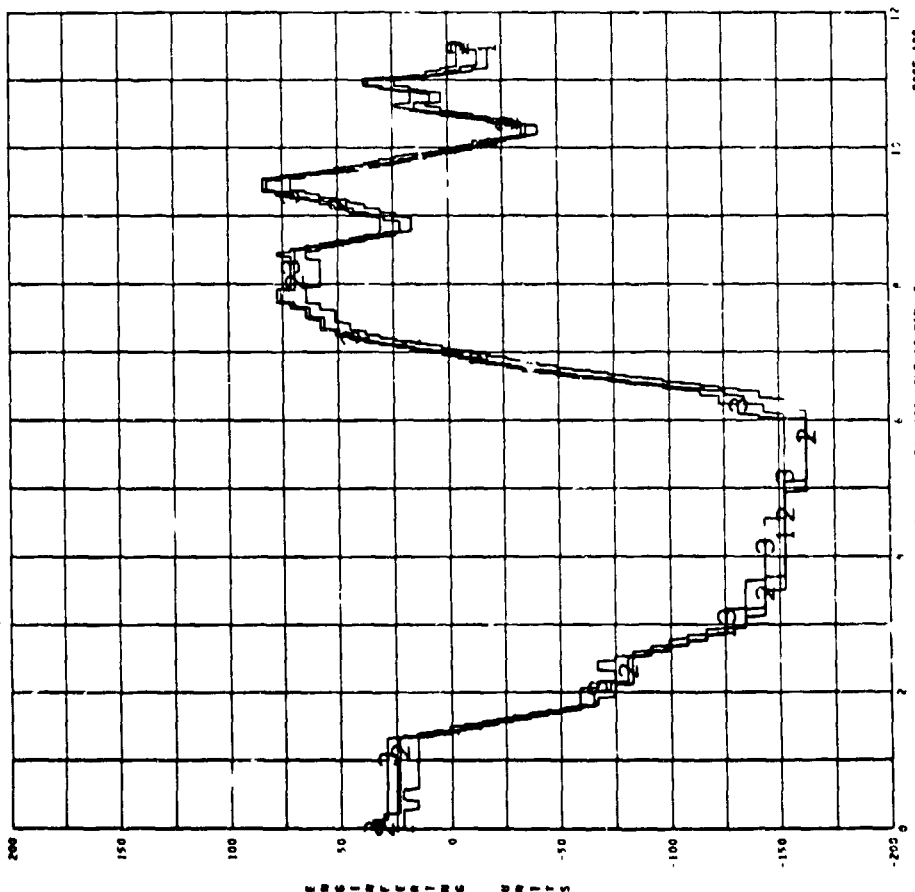


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1 AG7034 PANEL 7 T/C LOCATION 30 INTEGRATED TEST DATA GROUP 8- FLASH EVAPORATOR DEG F
 2 AG7035 PANEL 7 T/C LOCATION 35 DEG F
 3 AG7036 PANEL 7 T/C LOCATION 3A

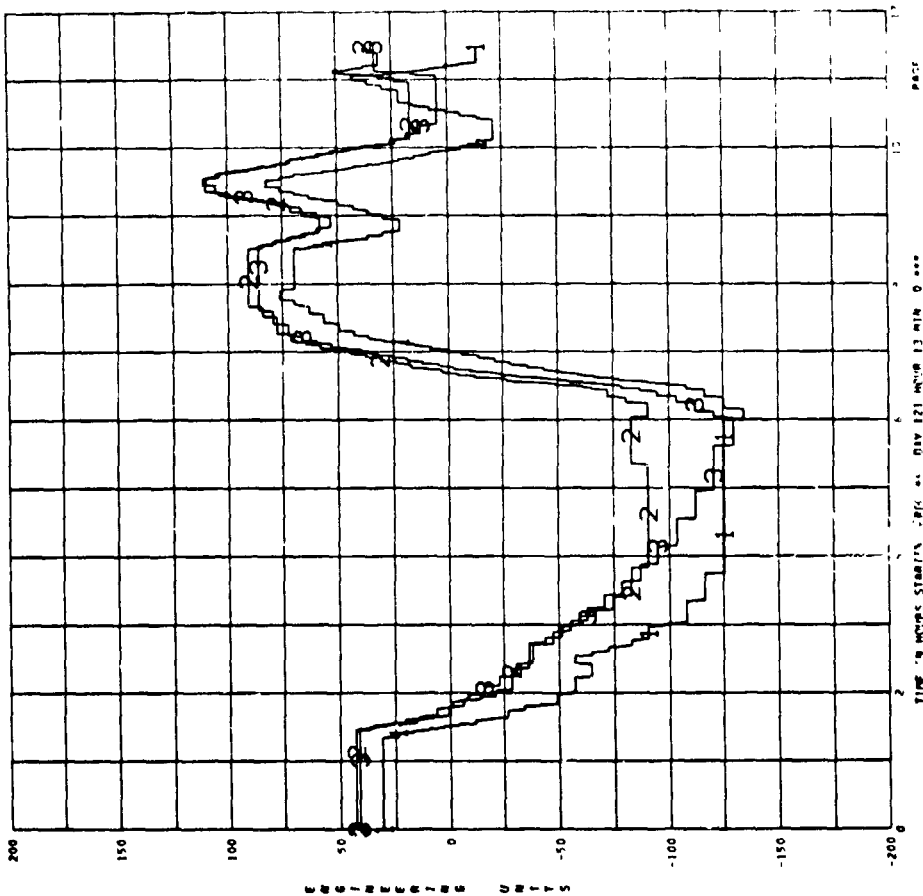


TIME IN HOURS STARTING FROM 000 DAY 121 HOUR 17 MIN 000

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1 AG7011 PANEL 7 T/C LOCATION 11 INTEGRATED TEST DATA GROUP 8- FLASH EVAPORATOR DEG F
 2 AG7018 PANEL 7 T/C LOCATION 1B DEG F
 3 AG7029 PANEL 7 T/C LOCATION 2A

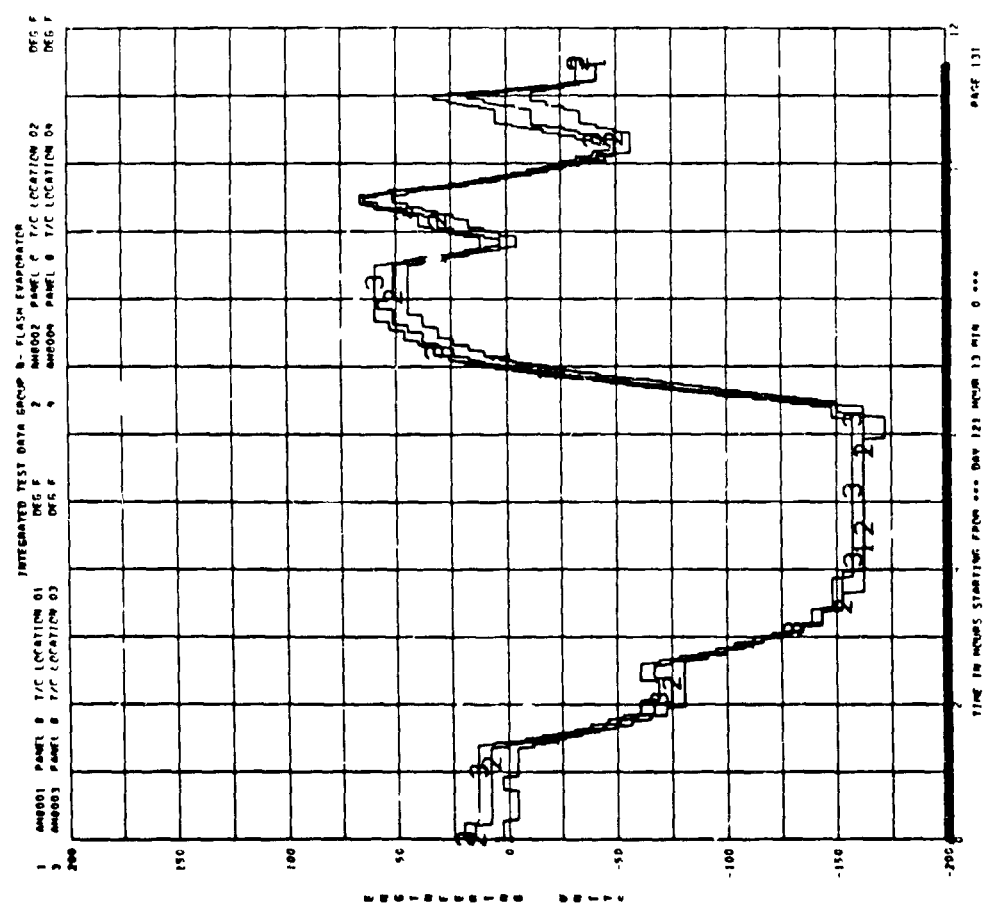


TIME IN HOURS STARTING FROM 000 DAY 121 HOUR 13 MIN 000

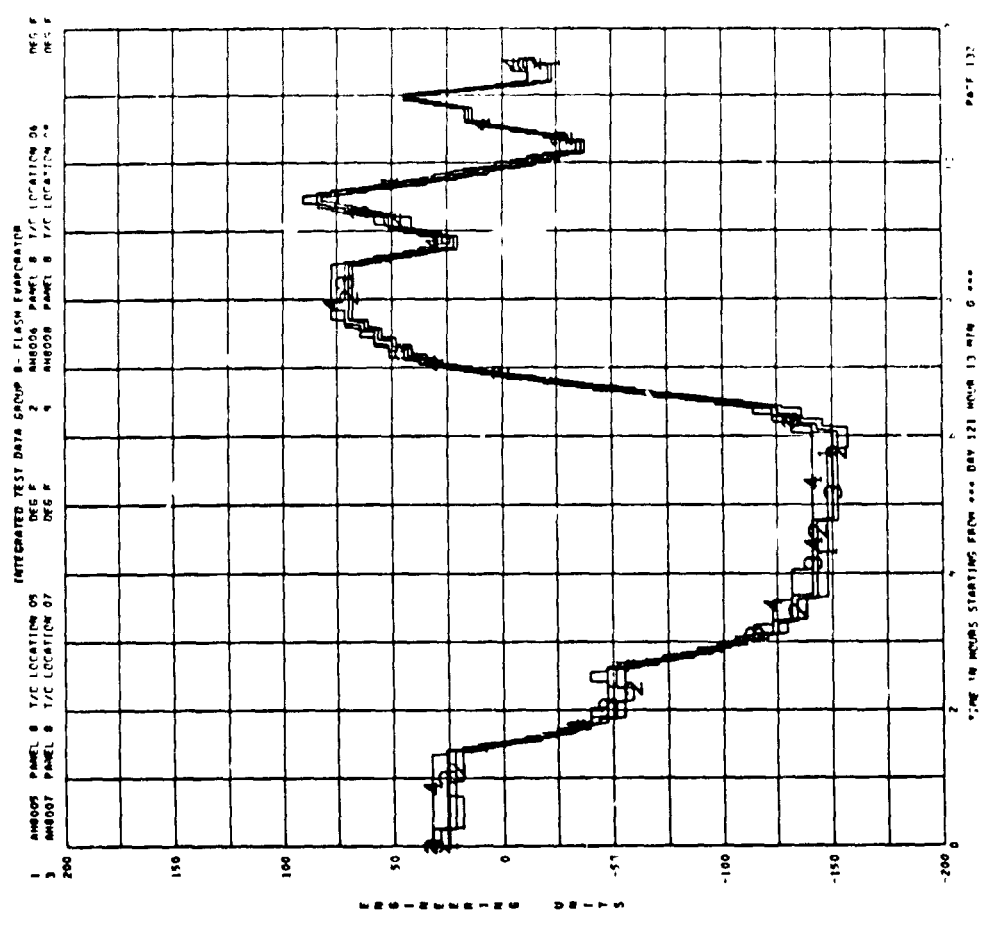
B-130

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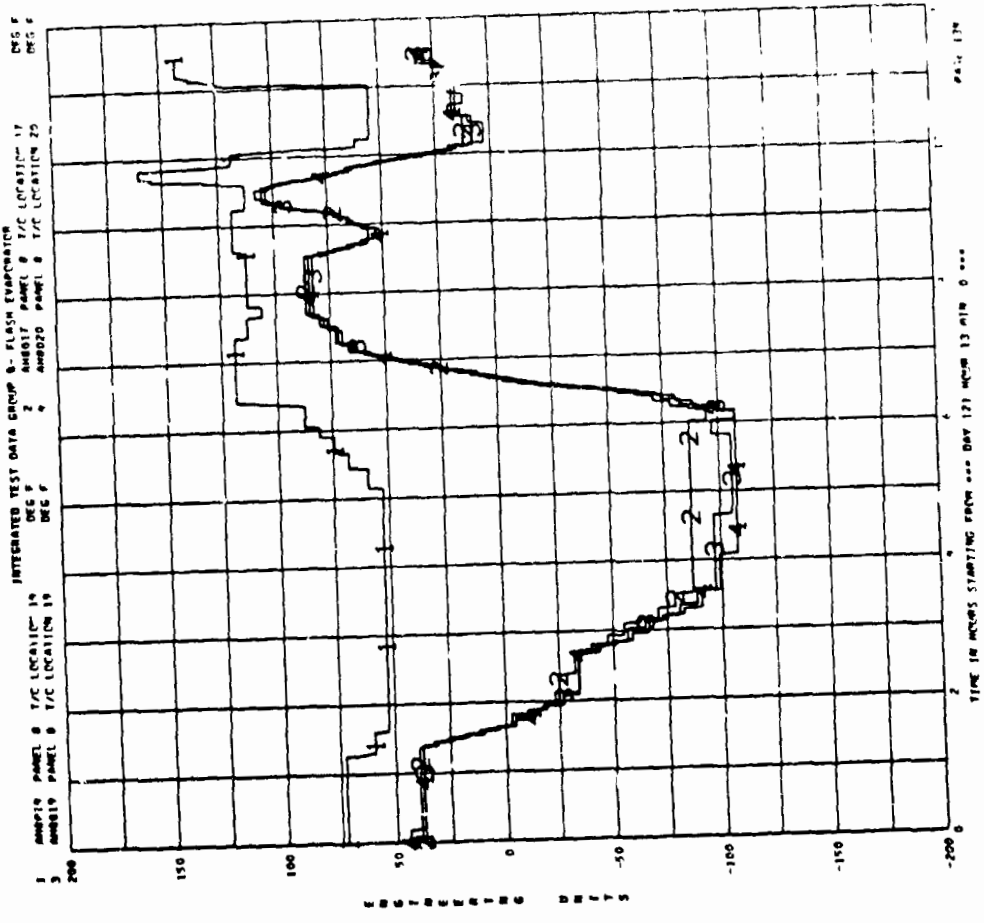
111



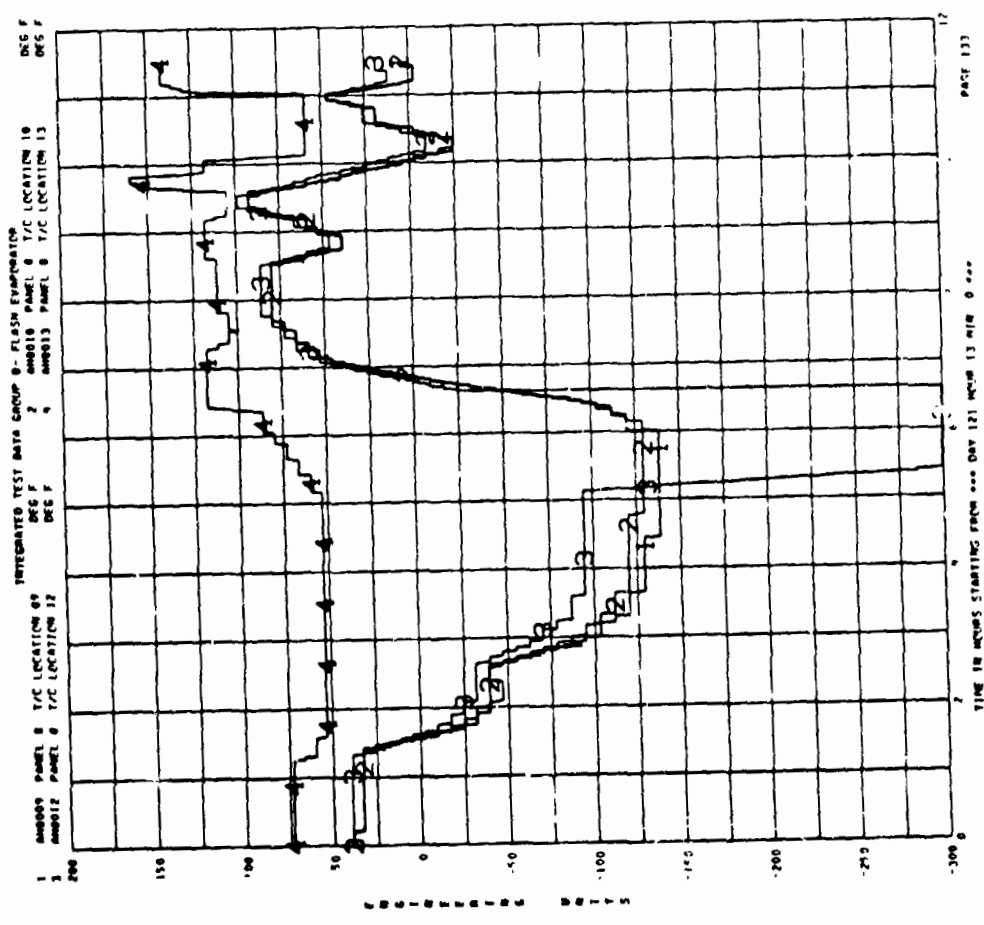
B-131



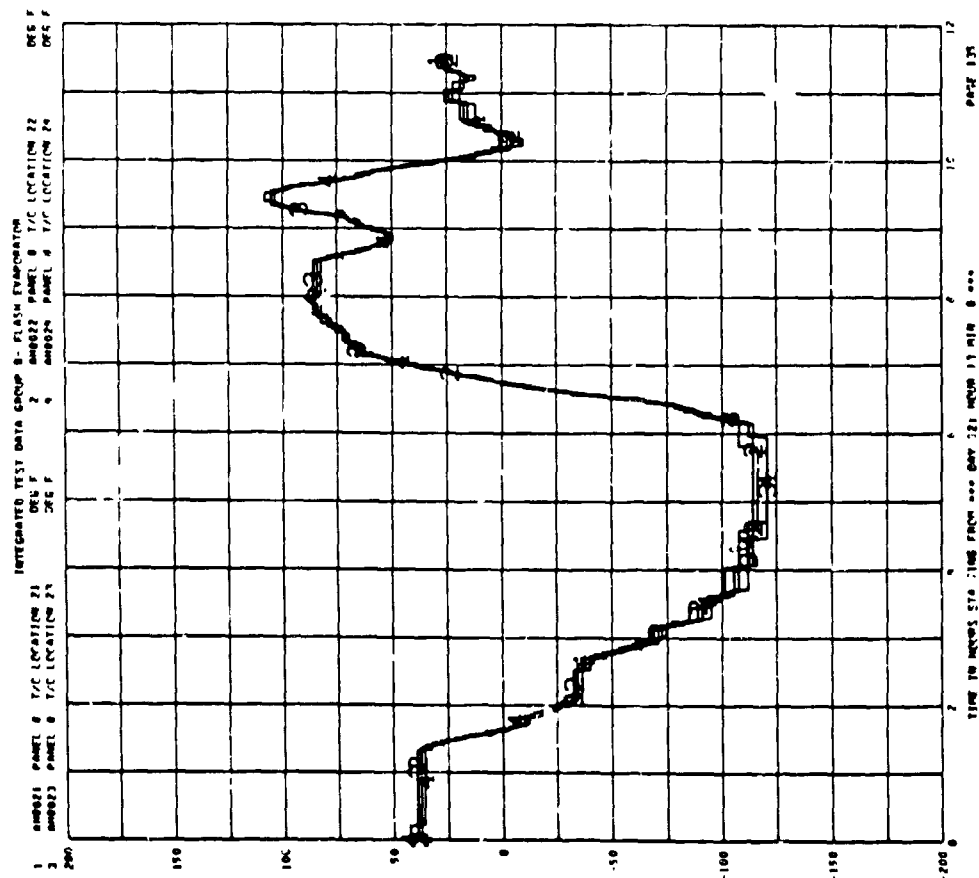
B-132



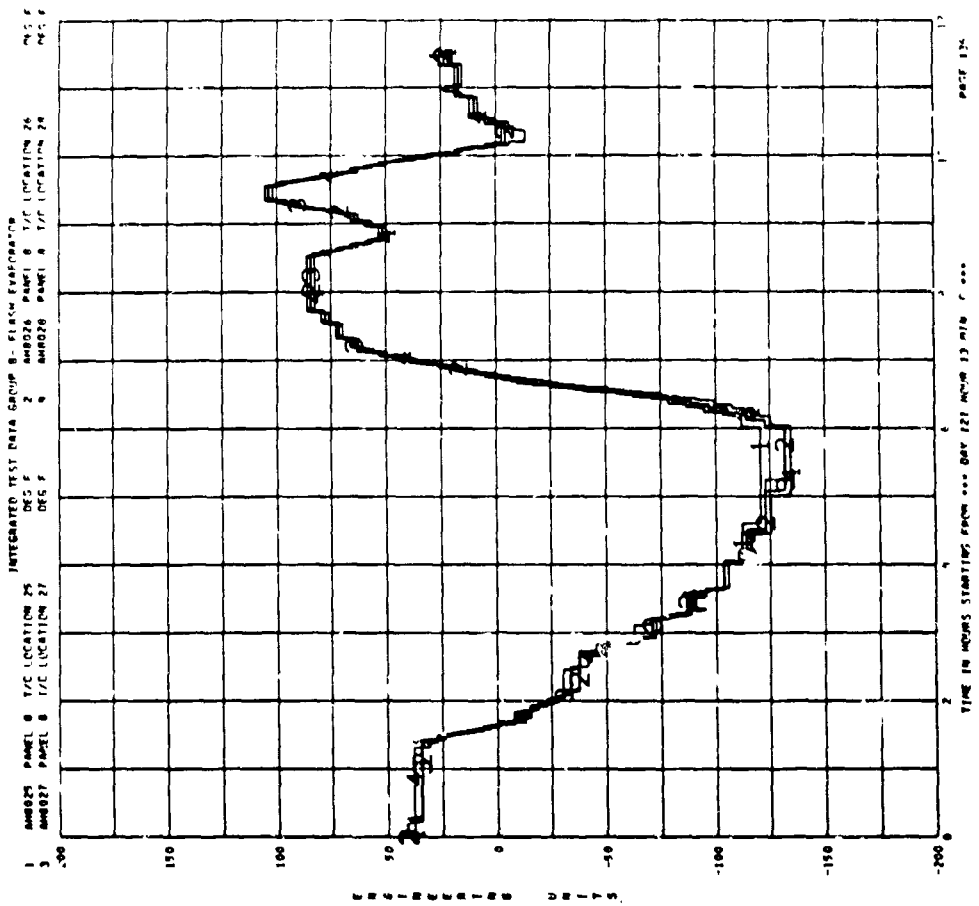
B-134



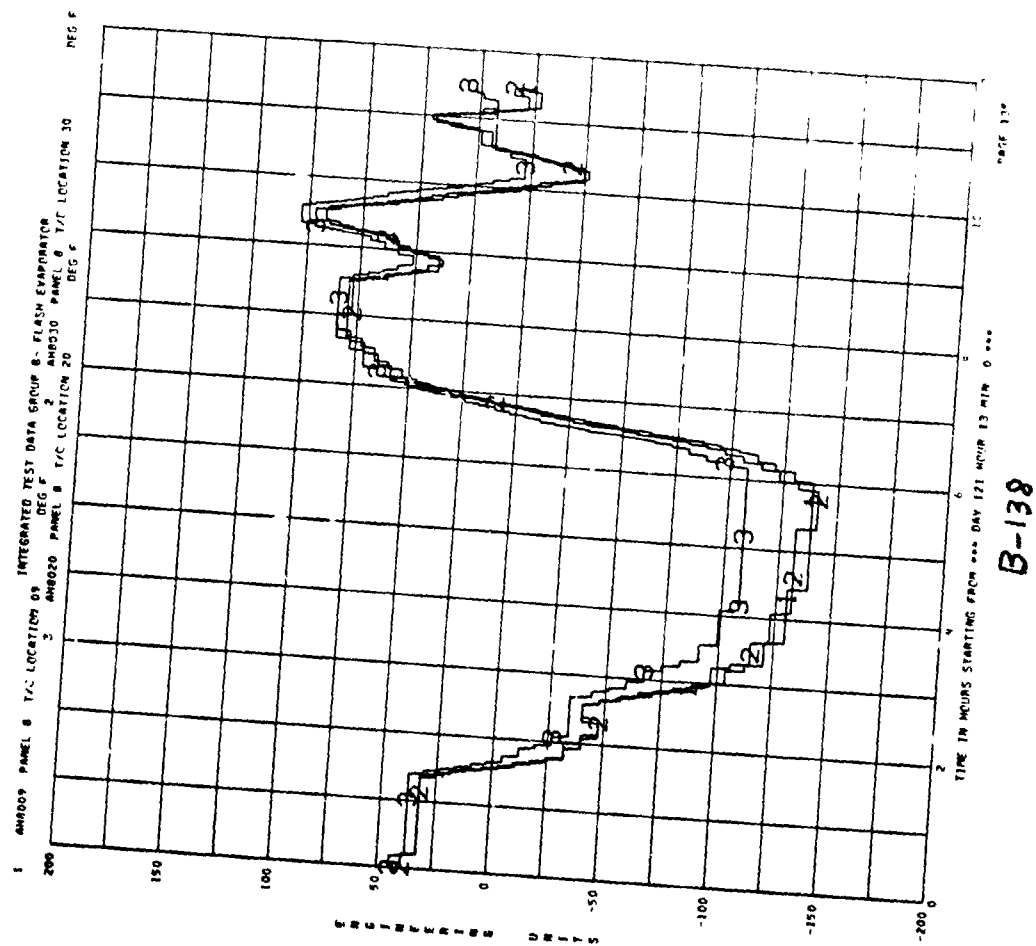
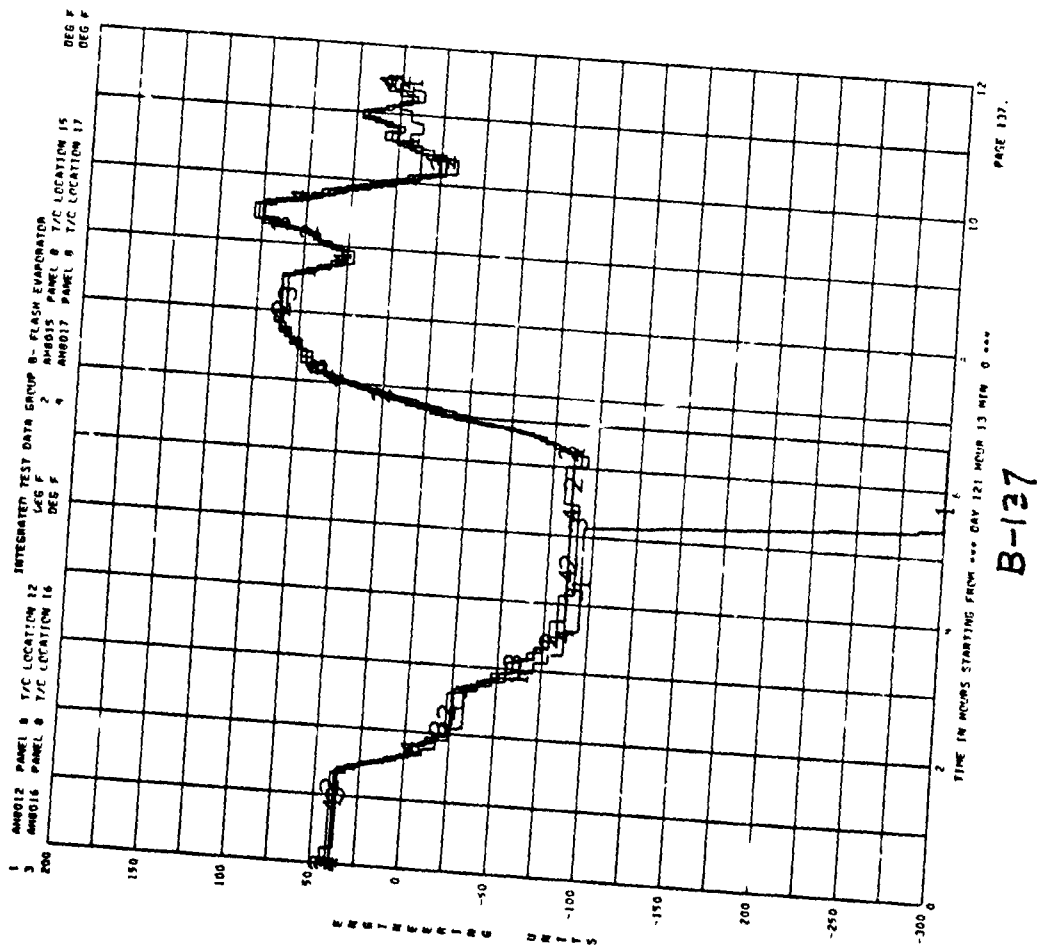
B-133



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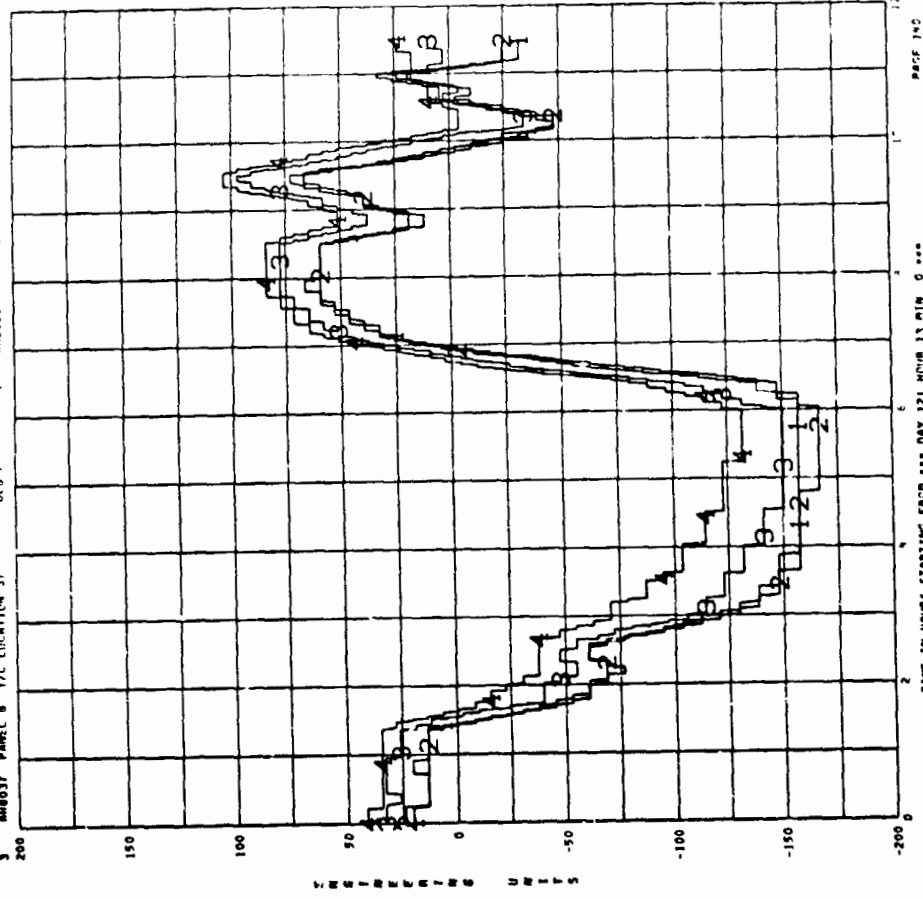


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INTEGRATED TEST DATA GROUP 8 - FLASH EVAPORATOR

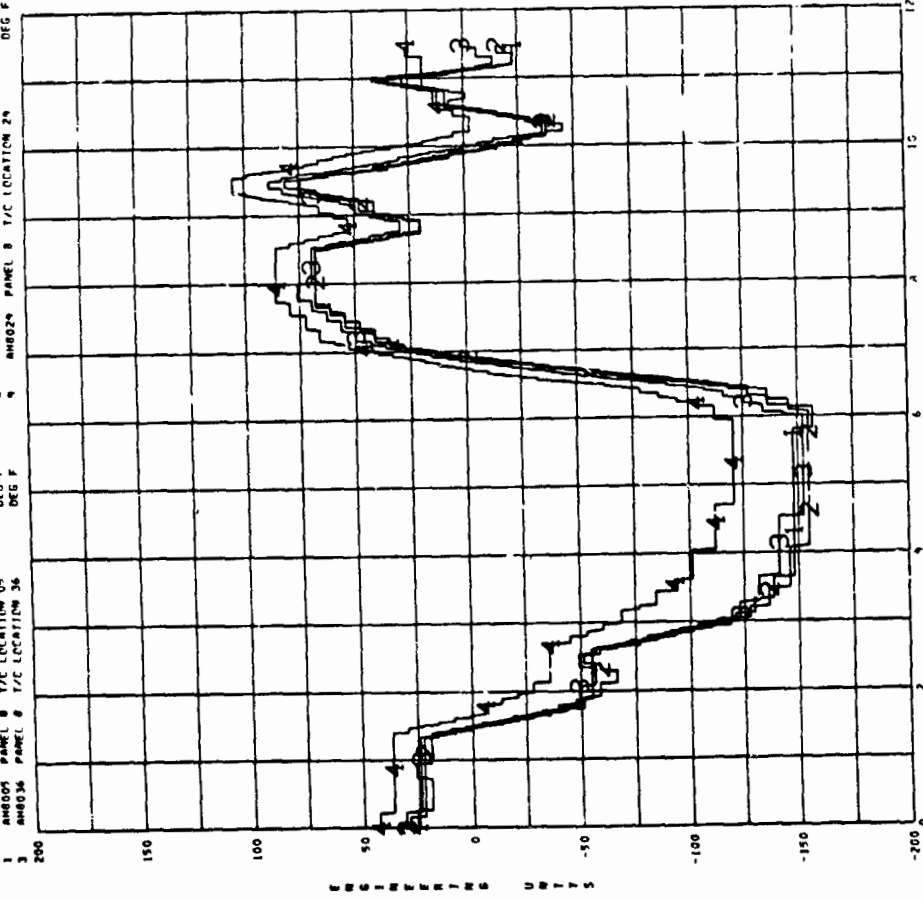
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
|--------|---------|-----------------|-------|---|--------|---------|-----------------|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| AN8003 | PANEL 8 | T/C LOCATION 03 | DEG F | 2 | AN8032 | PANEL 8 | T/C LOCATION 32 | DEG F | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AN8037 | PANEL 8 | T/C LOCATION 37 | DEG F | 4 | AN8026 | PANEL 8 | T/C LOCATION 26 | DEG F | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



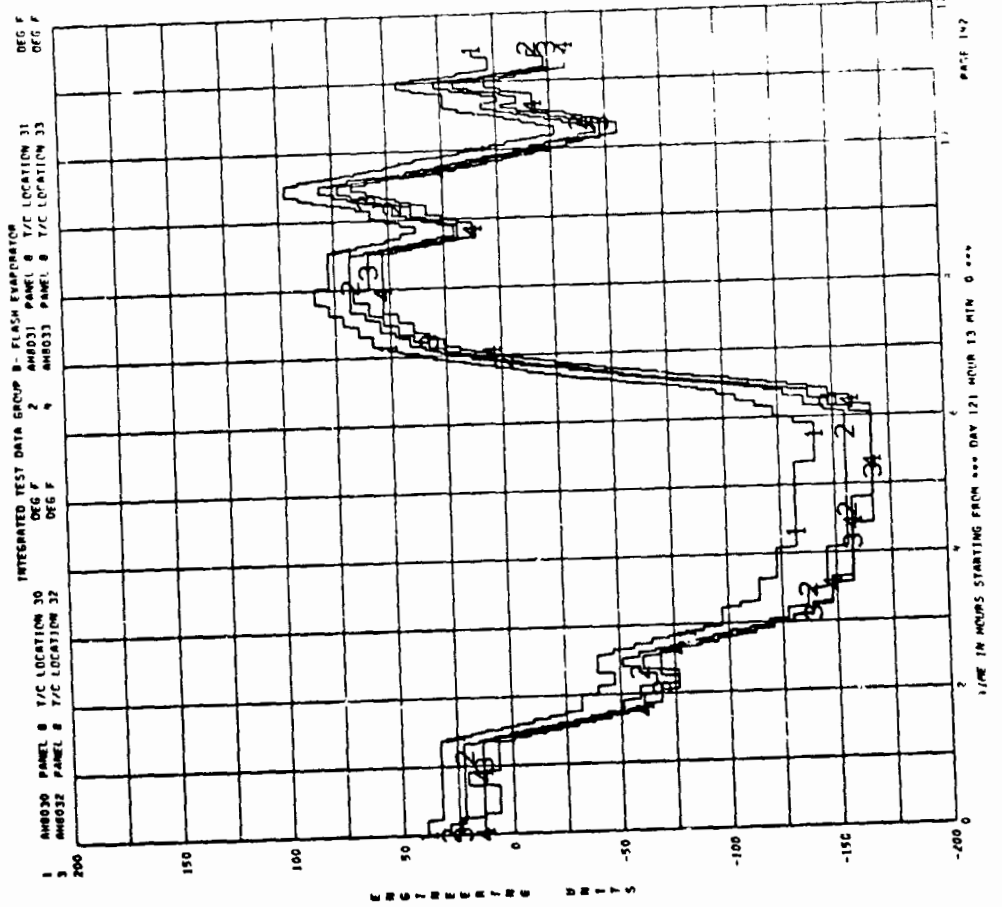
B-140

INTEGRATED TEST DATA GROUP 8 - FLASH EVAPORATOR

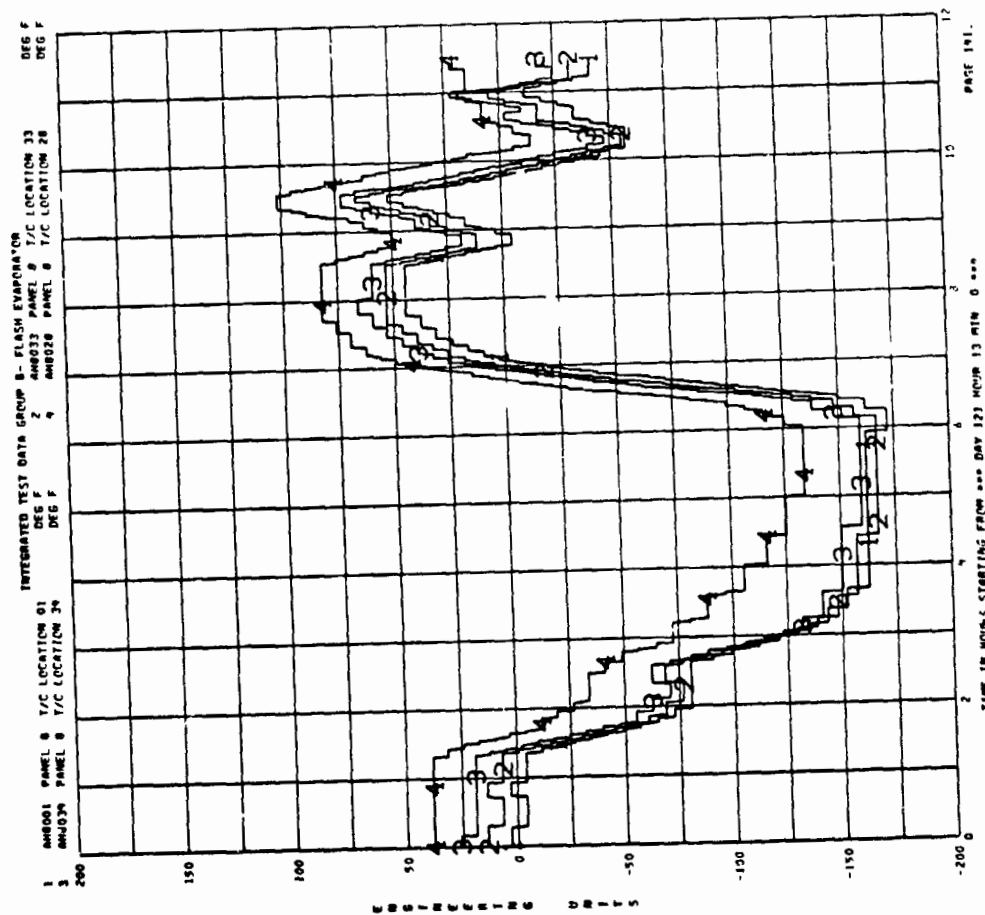
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
|--------|---------|-----------------|-------|---|--------|---------|-----------------|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| AN8005 | PANEL 8 | T/C LOCATION 05 | DEG F | 2 | AN8031 | PANEL 8 | T/C LOCATION 31 | DEG F | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AN8036 | PANEL 8 | T/C LOCATION 36 | DEG F | 4 | AN8024 | PANEL 8 | T/C LOCATION 24 | DEG F | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



B-139

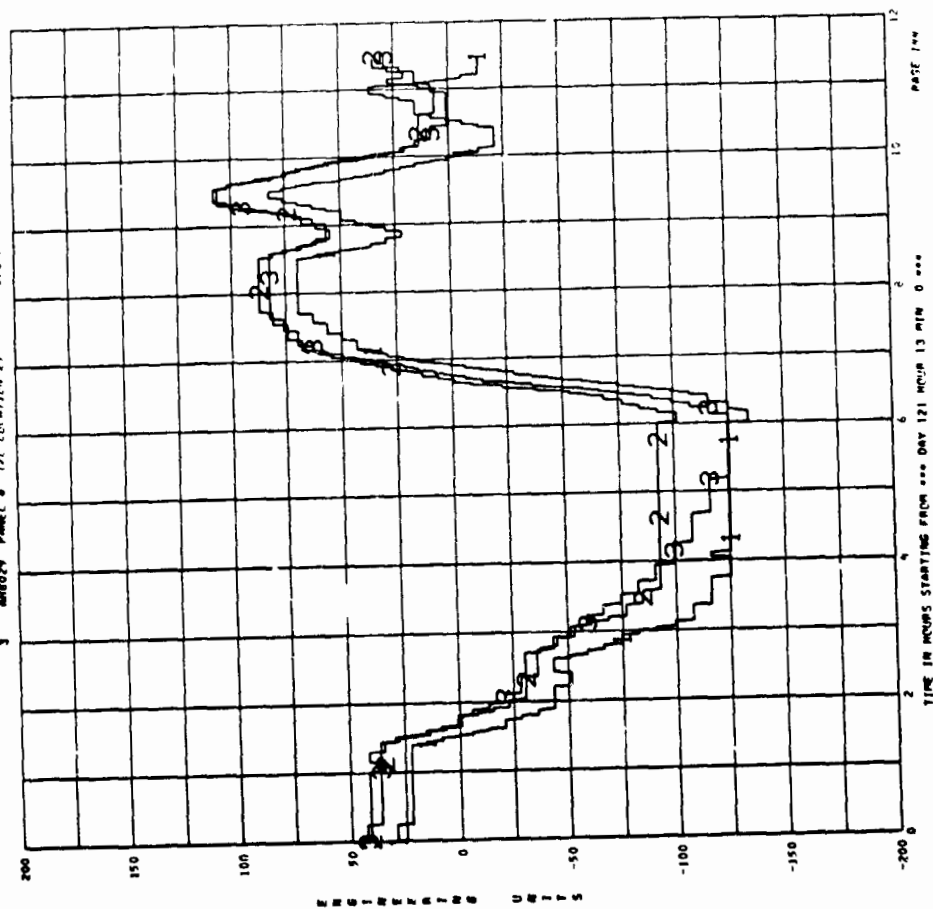


B-142



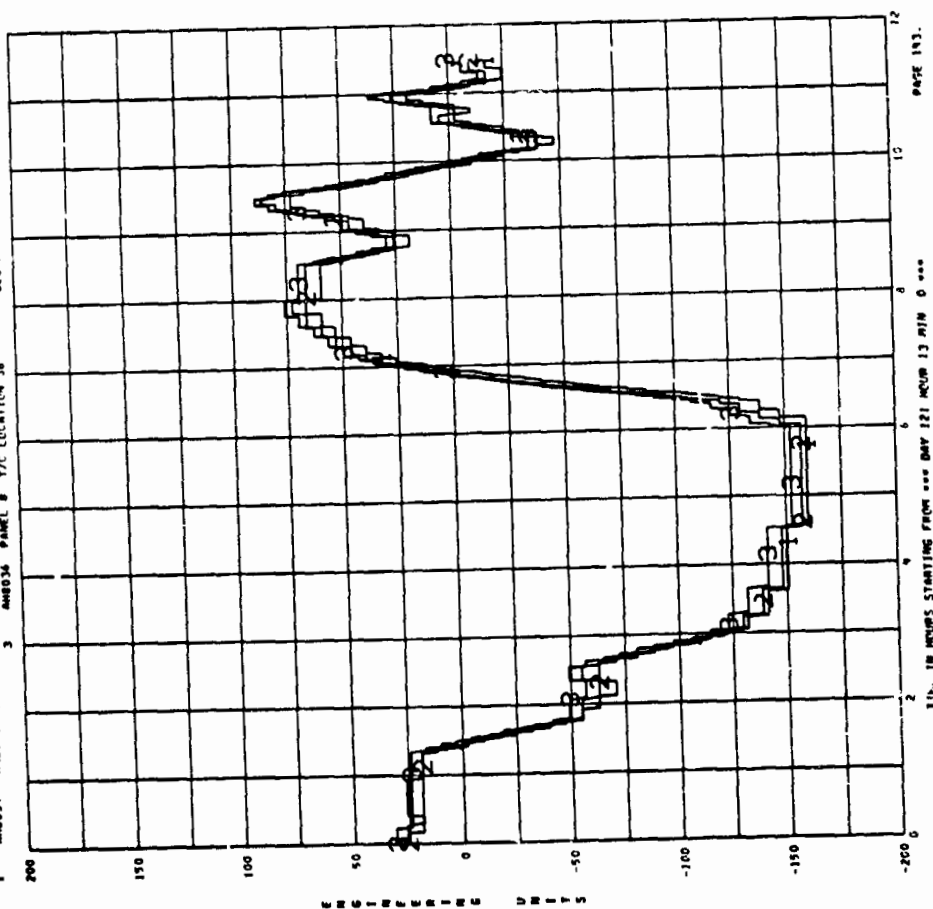
B-141

1 AM8011 PANEL B T/C LOCATION 11 DEG F
 2 AM8029 PANEL B T/C LOCATION 29 DEG F
 3 AM8010 PANEL B T/C LOCATION 18 DEG F



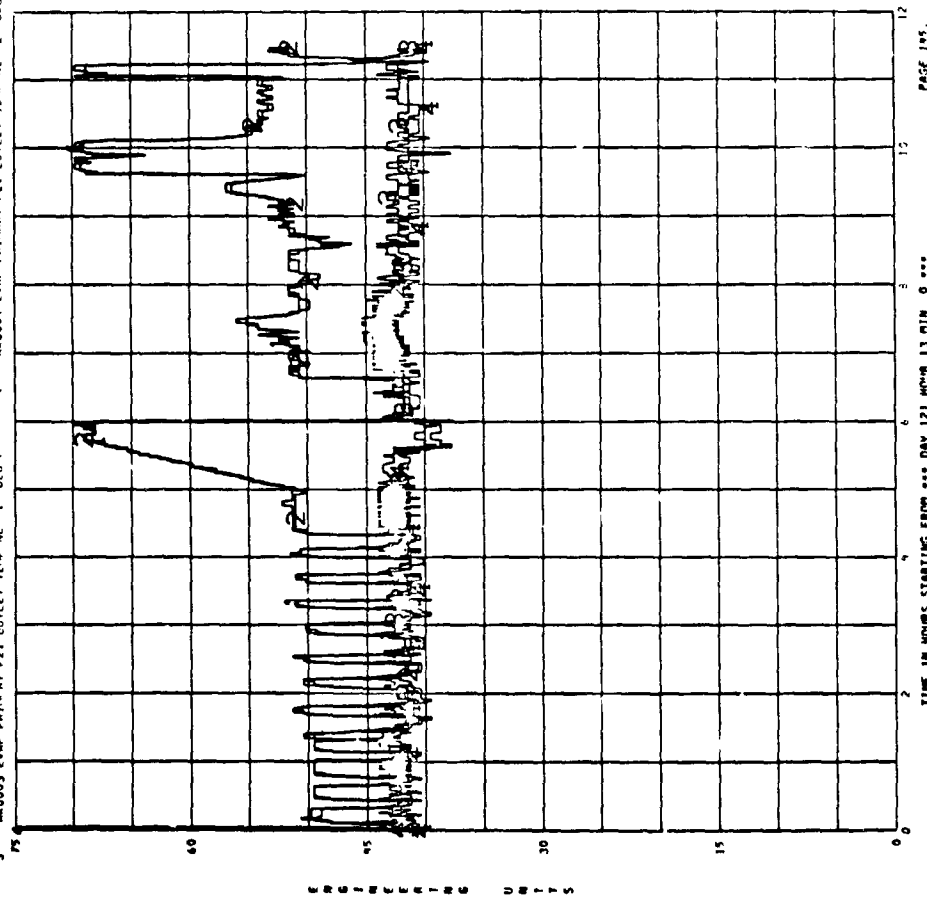
B-144

1 AM8034 PANEL B T/C LOCATION 34 DEG F
 2 AM8035 PANEL B T/C LOCATION 35 DEG F
 3 AM8036 PANEL B T/C LOCATION 36 DEG F



B-143

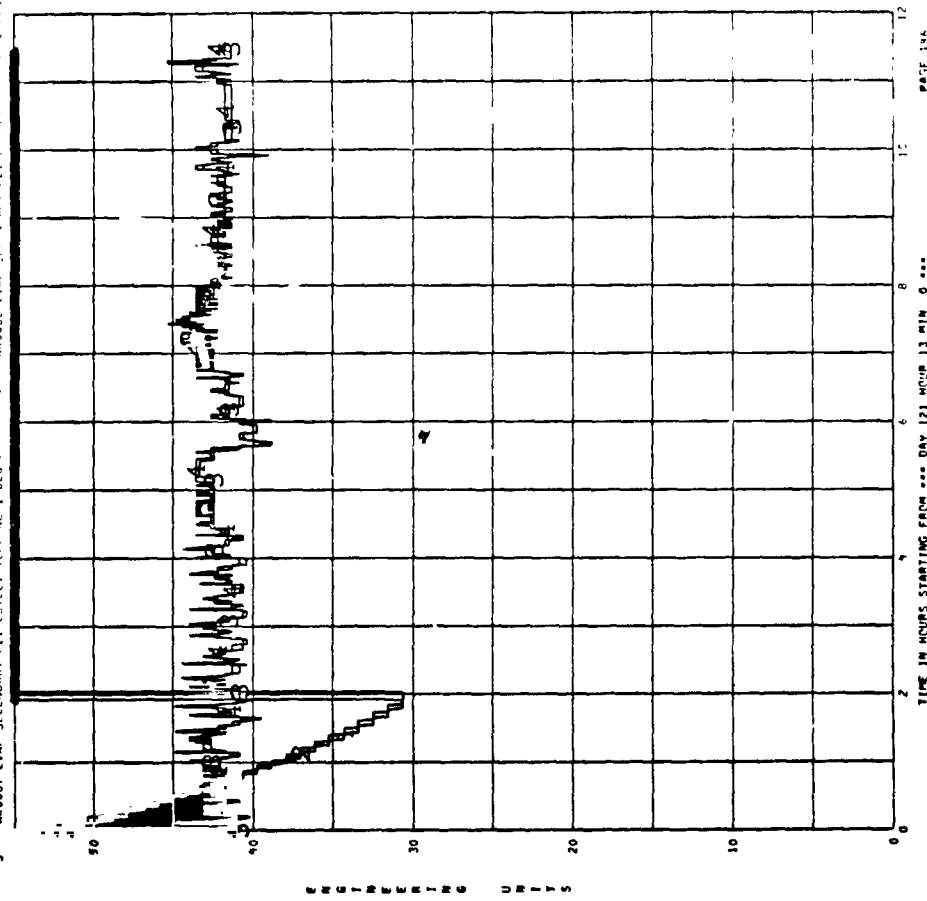
INTEGRATED TEST DATA GROUP B - FLASH EVAPORATOR
 1 AC0001 EVAP PRIMARY F21 INLET TEMP NO 1 DEG F
 2 AC0002 EVAP PRIMARY F21 INLET TEMP NO 2 DEG F
 3 AC0003 EVAP PRIMARY F21 OUTLET TEMP NO 1 DEG F
 4 AC0004 EVAP PRIMARY F21 OUTLET TEMP NO 2 DEG F



B-145

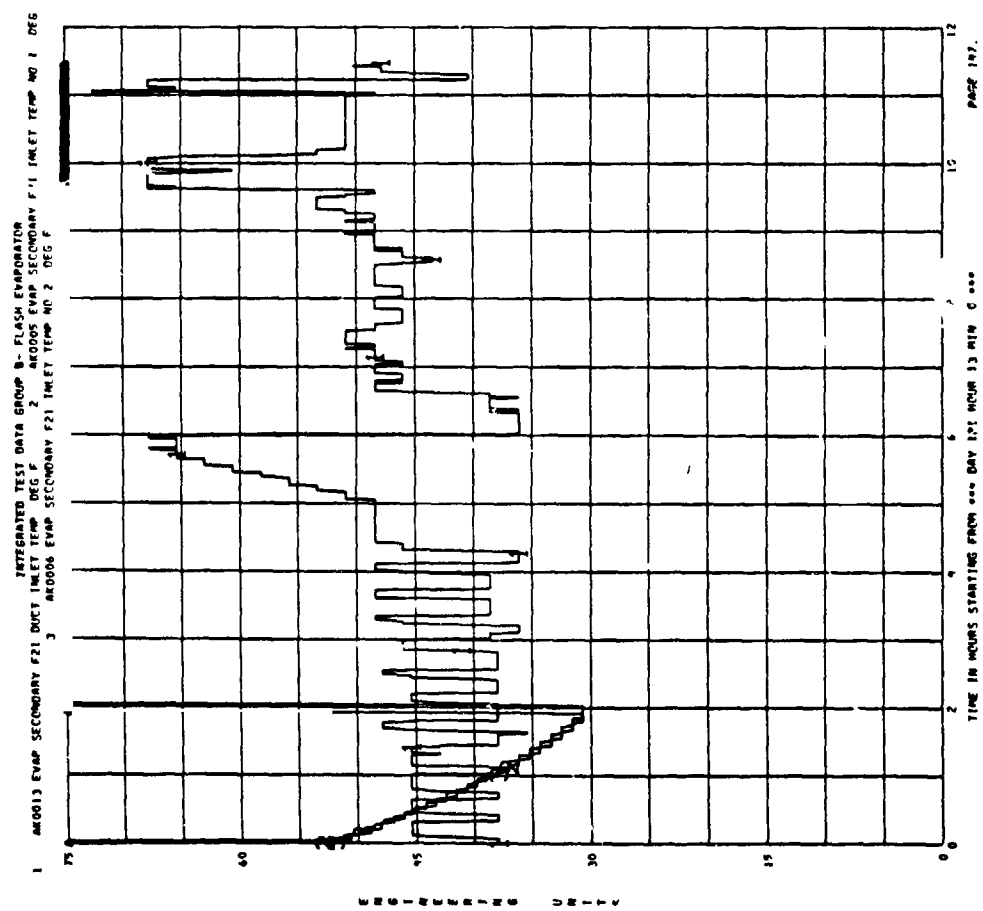
PAGE 145

INTEGRATED TEST DATA GROUP B - FLASH EVAPORATOR
 1 AC0005 EVAP SECONDARY F21 INLET TEMP NO 1 DEG F
 2 AC0006 EVAP SECONDARY F21 INLET TEMP NO 2 DEG F
 3 AC0007 EVAP SECONDARY F21 OUTLET TEMP NO 1 DEG F
 4 AC0008 EVAP SECONDARY F21 OUTLET TEMP NO 2 DEG F

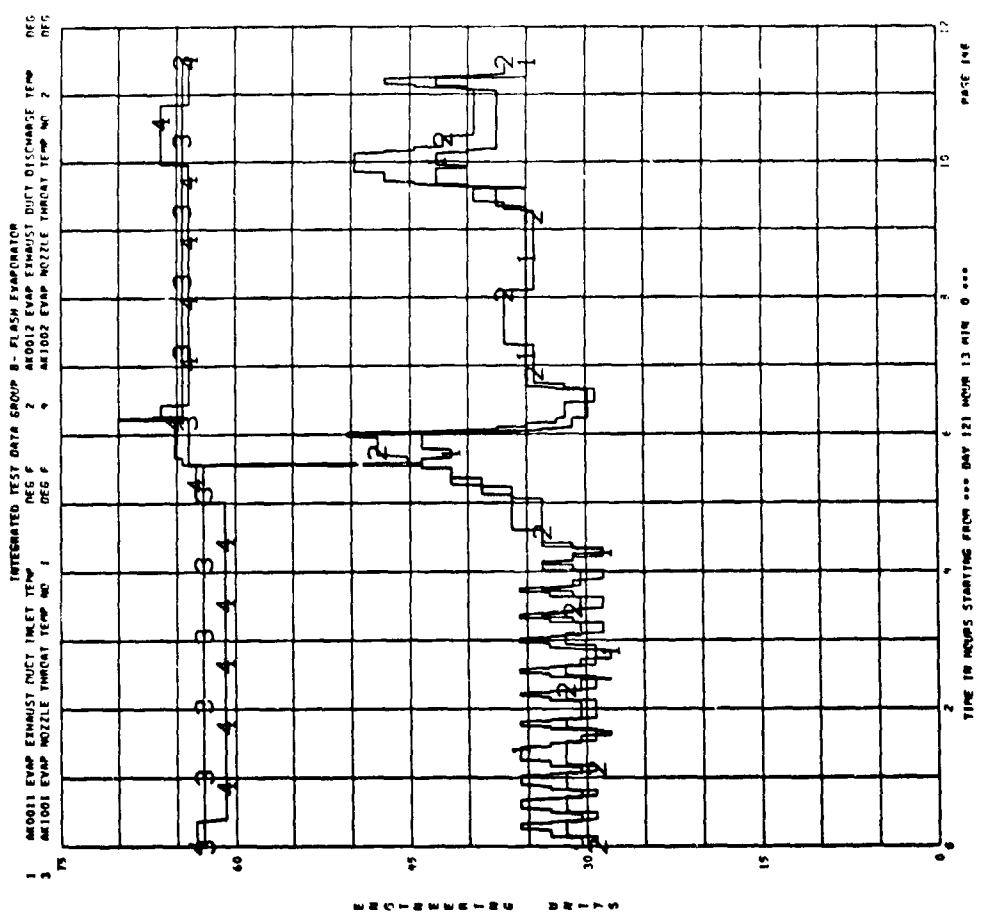


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B-148

1990年12月1日 星期一

TIME IN HOURS STARTING FROM *** DAY 121 HOUR 13 MIN 0 ***

12

10

8

6

4

2

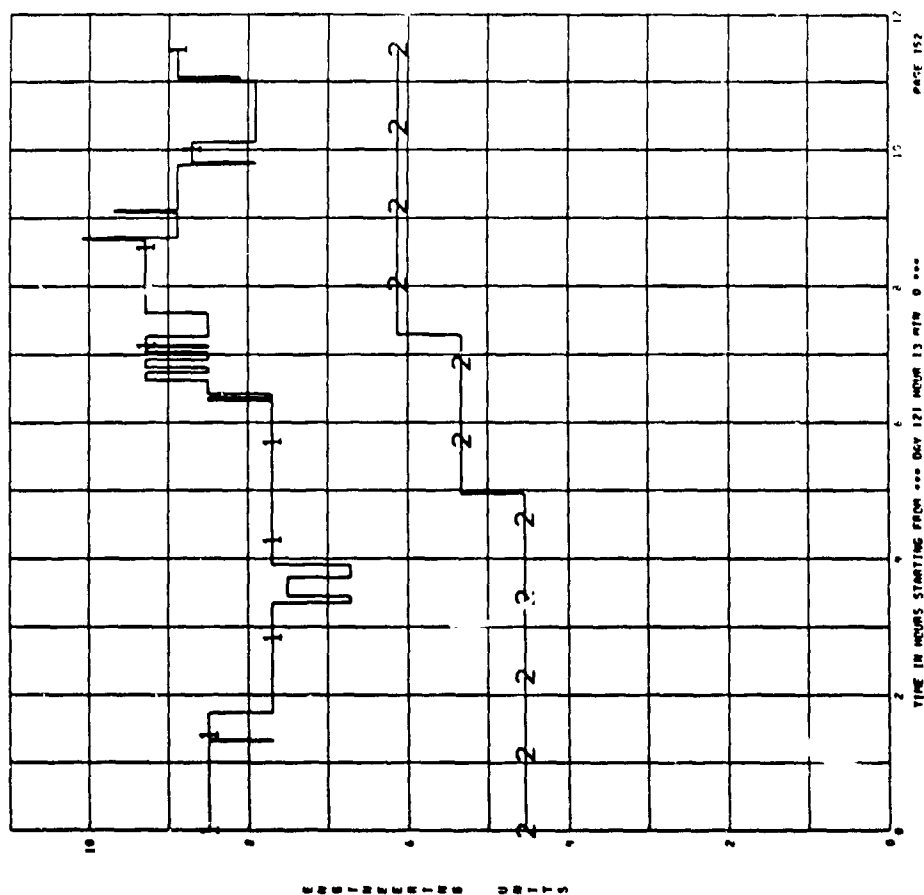
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0 2 4 6 8 10 12

B-149

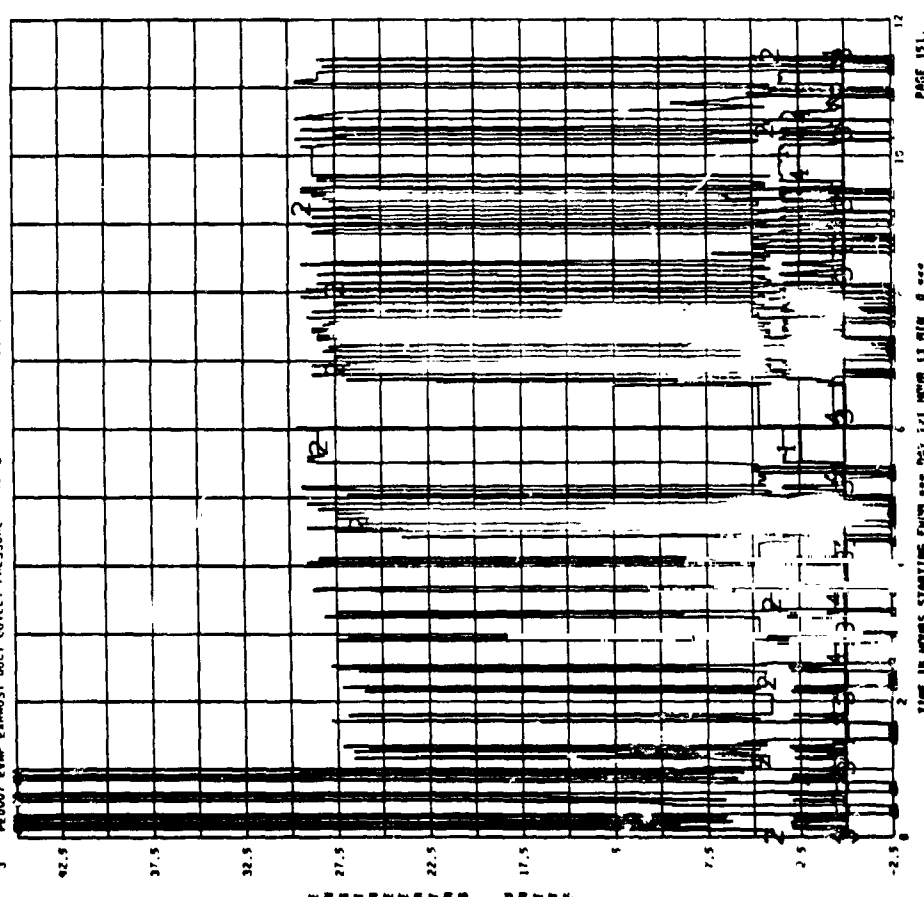
Page 3208

| INTEGRATED TEST DATA GROUP 3- FLASH EVAPORATOR | | | |
|--|------|---|--|
| PE0004 EVAP F21 DELTA PRESSURE PRIMARY | PSID | 2 | PE0005 EVAP F21 DELTA PRESSURE SECONDARY |
| 1 | 1 | 1 | 1 |



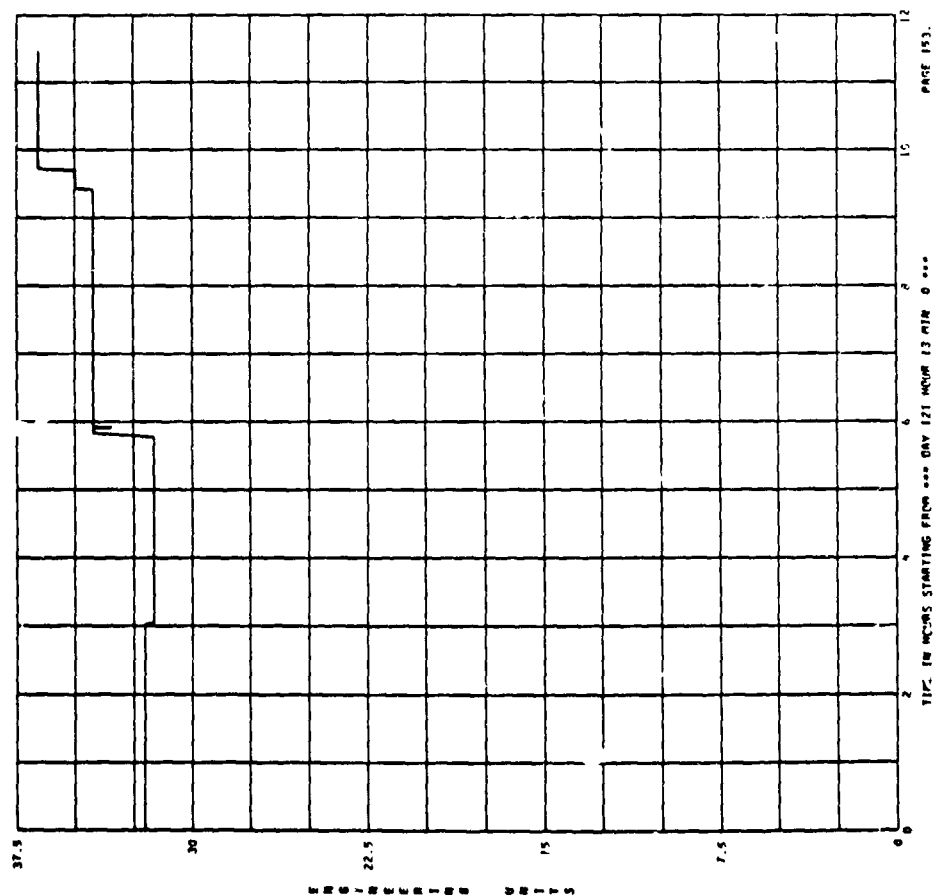
8-152

| INTEGRATED TEST DATA GROUP B - FLASH EVAPORATOR | | | |
|---|--------|-----------------------------------|------|
| 1 | PE0001 | EVAP CHAMBER PRESSURE | mmHg |
| 2 | PE0006 | EVAP EXHAUST DUCT INLET PRESSURE | mmHg |
| 3 | PE0007 | EVAP EXHAUST DUCT OUTLET PRESSURE | mmHg |
| 4 | PE1001 | EVAP NOZZLE CHAMBER PRESSURE | mmHg |



B-151

INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
 PERIOD EVAP NO2 TANK PRESSURE
 PSIA

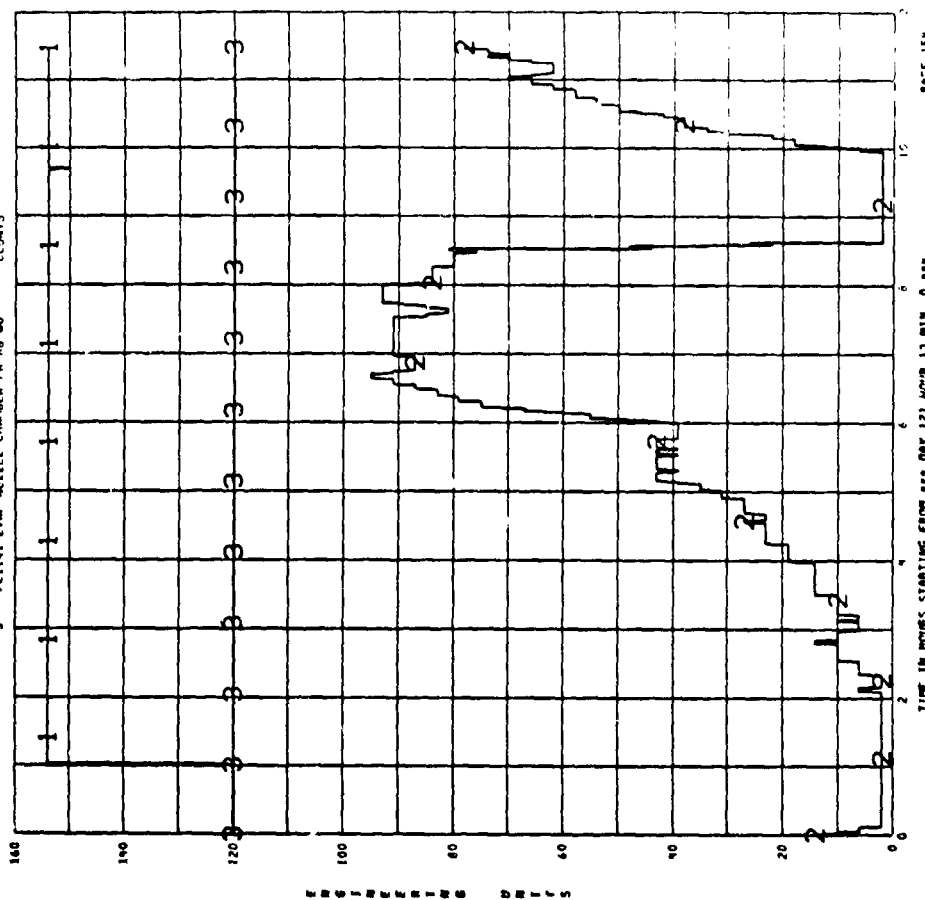


PAGE 153.

TIME IN HOURS STARTING FROM *** DAY 121 HOUR 13 MIN 0 ***

B-153

INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
 PERIOD EVAP INLET NO2 COUNTS 1 PERIOD EVAP EXHAUST
 DUCT OUTLET NO2 COUNTS 2 PERIOD EVAP NOZZLE CHAMBER NO2
 COUNTS 3

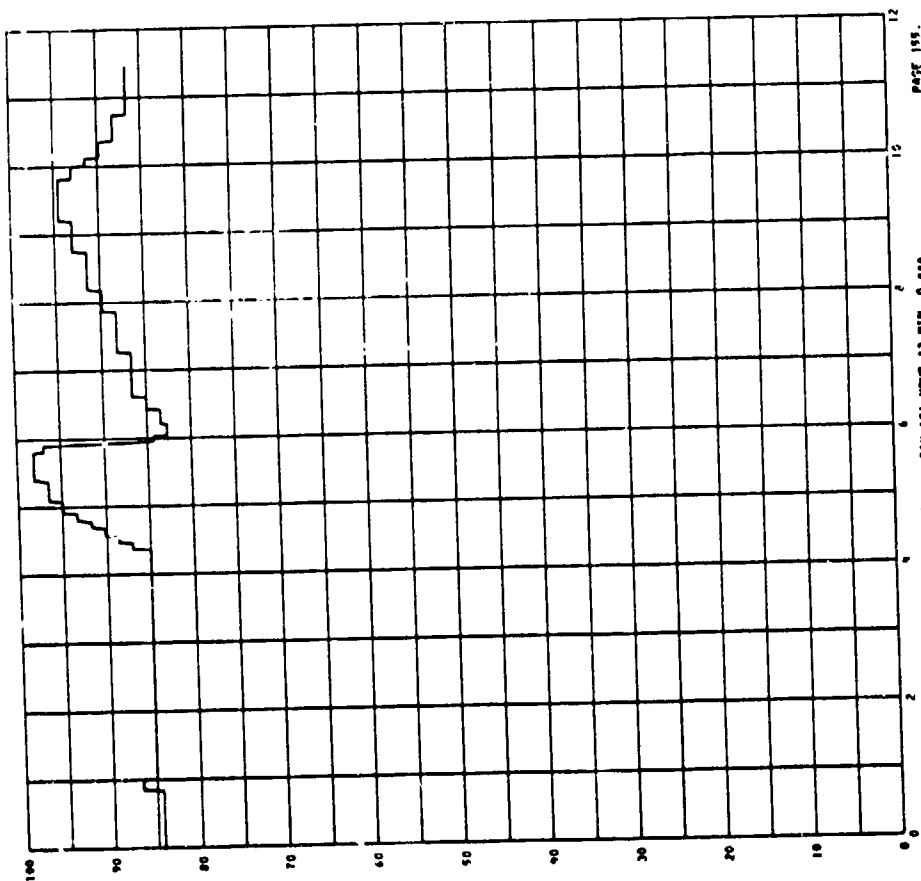


PAGE 154

TIME IN HOURS STARTING FROM *** DAY 121 HOUR 13 MIN 0 ***

B-154

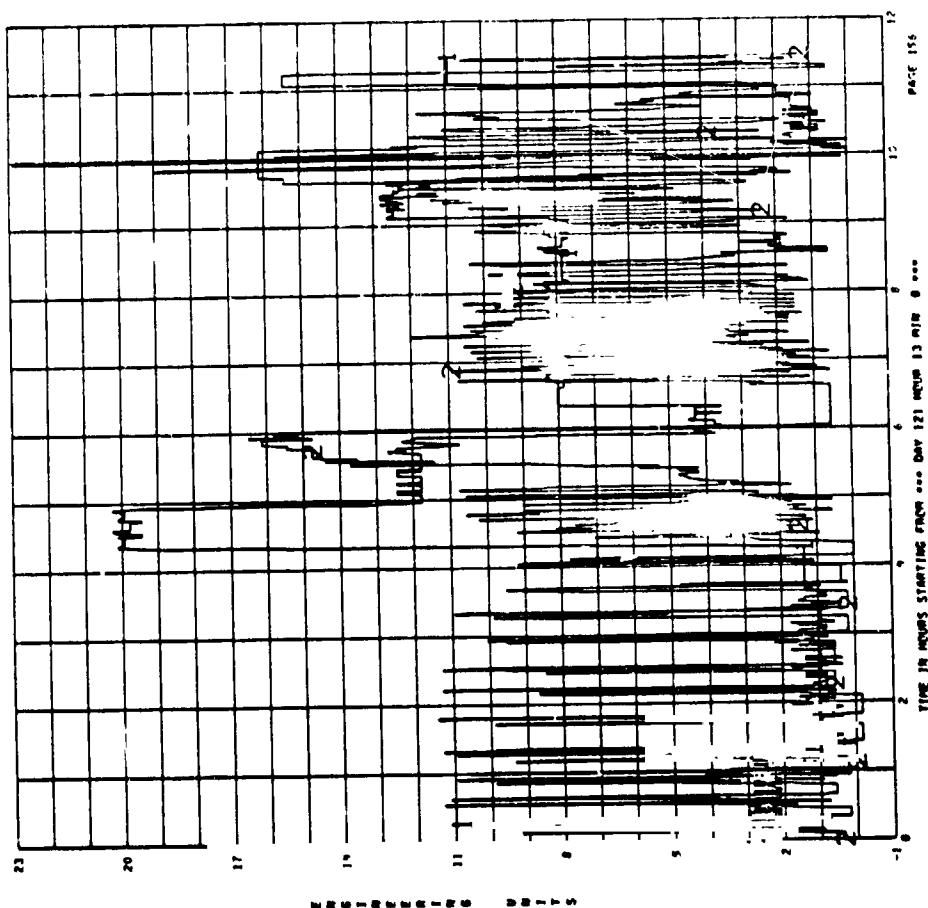
INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
1 LK0081 EVAP H2O TANK QUANTITY LP



B-155

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INTEGRATED TEST DATA GROUP B- FLASH EVAPORATOR
1 PW0001 H2O FLOW INTO TANK
2 PW0002 H2O FLOW FROM TANK TO EVAP (9.5411 LBS/



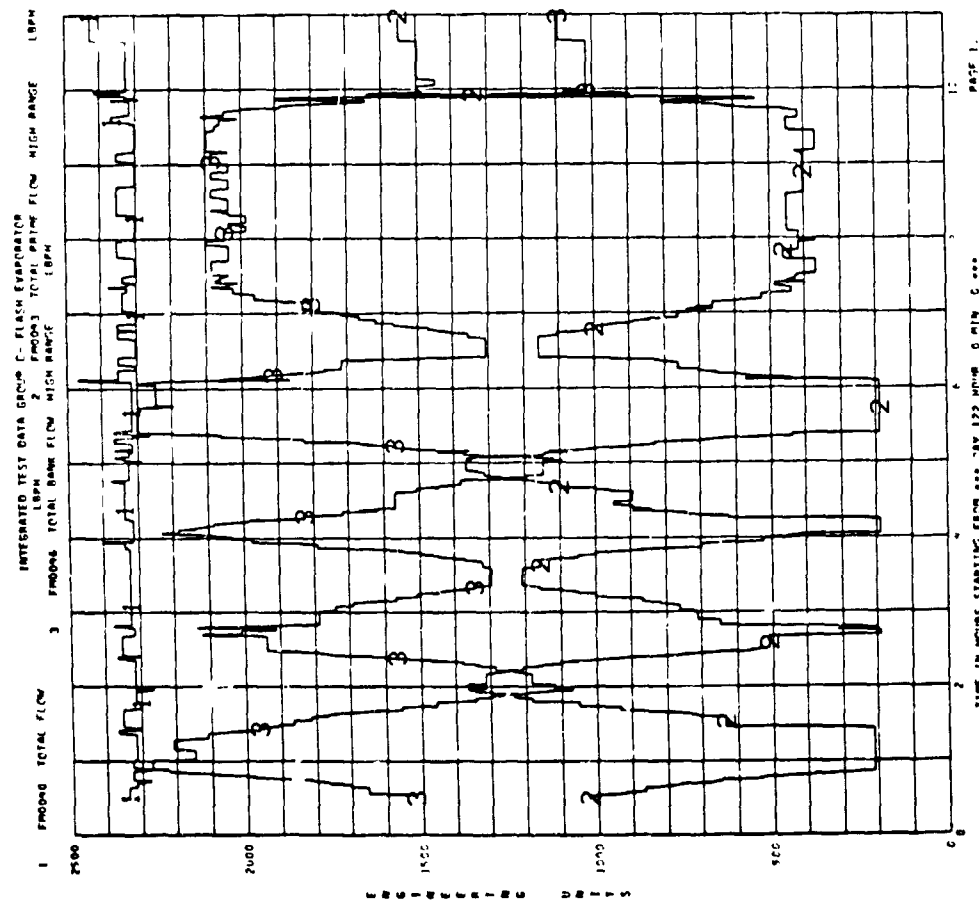
B-156

PAGE 156

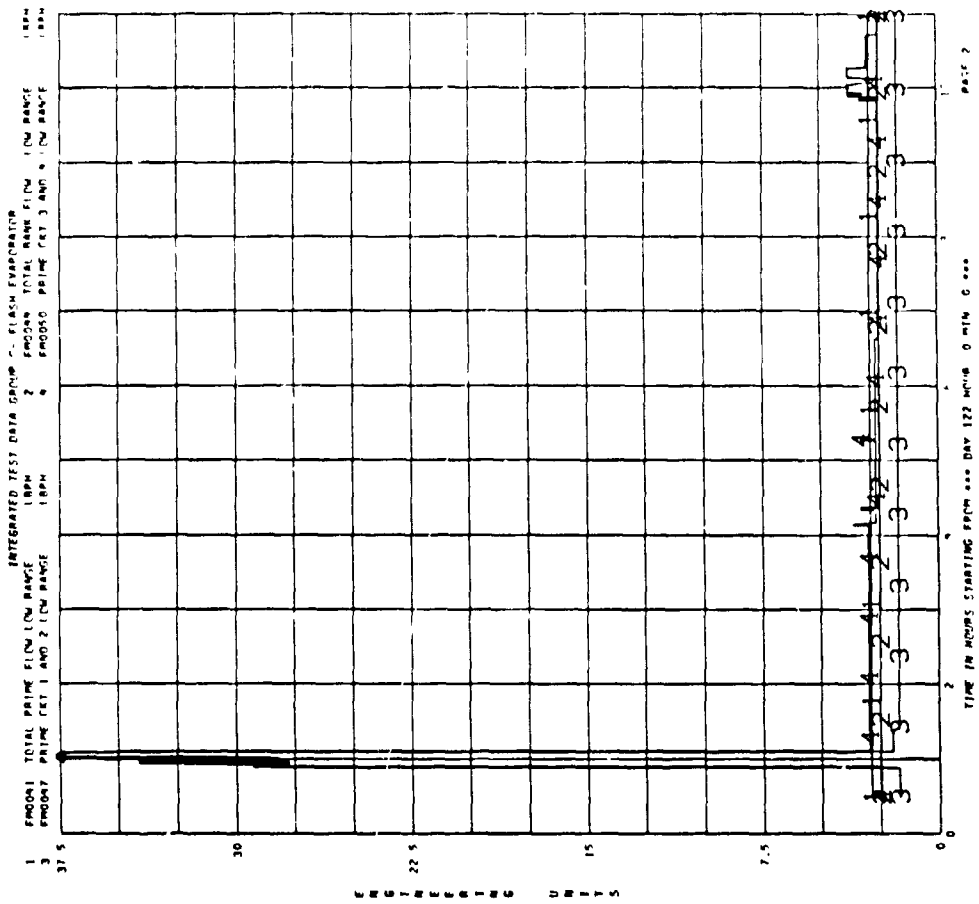
DATA GROUP C

TEST POINTS 15-23

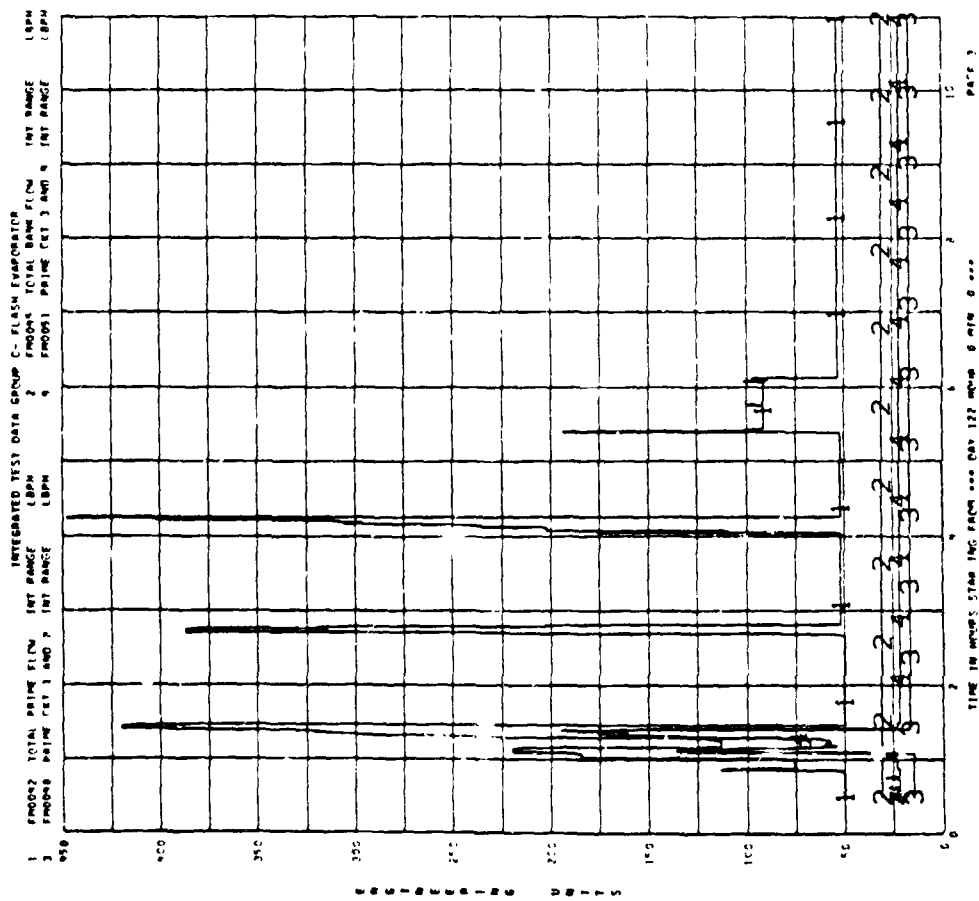
From Day 122, 0030 to Day 122, 1100



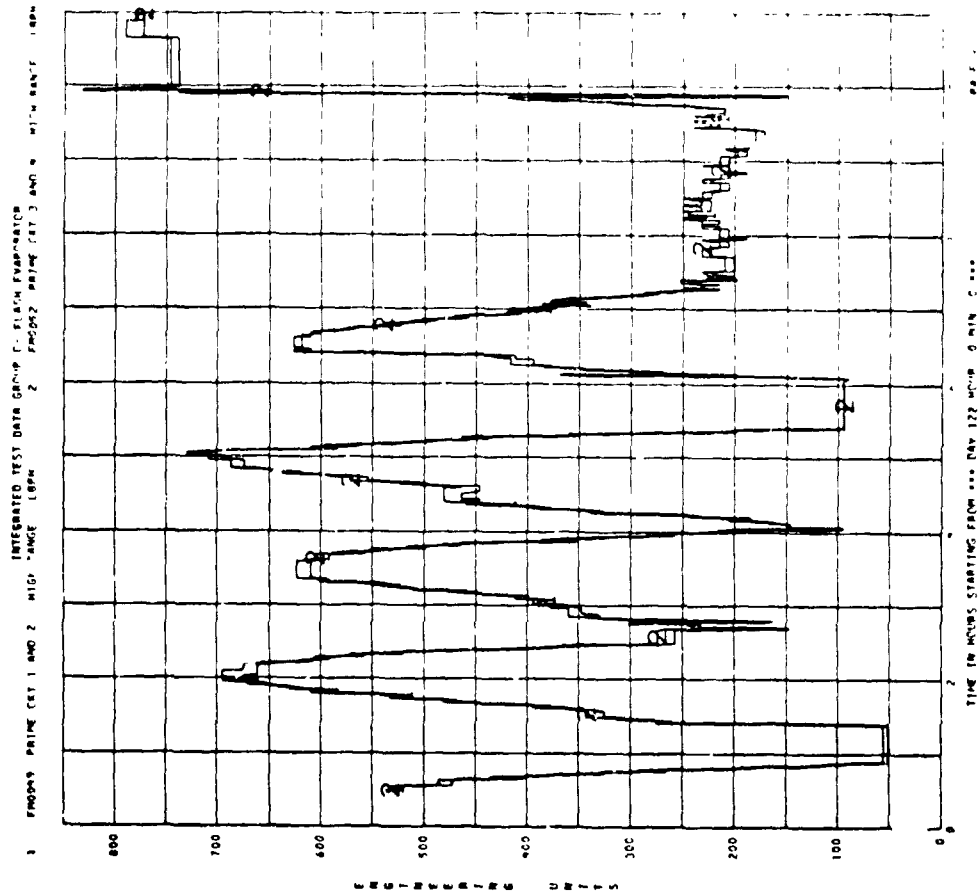
C-1



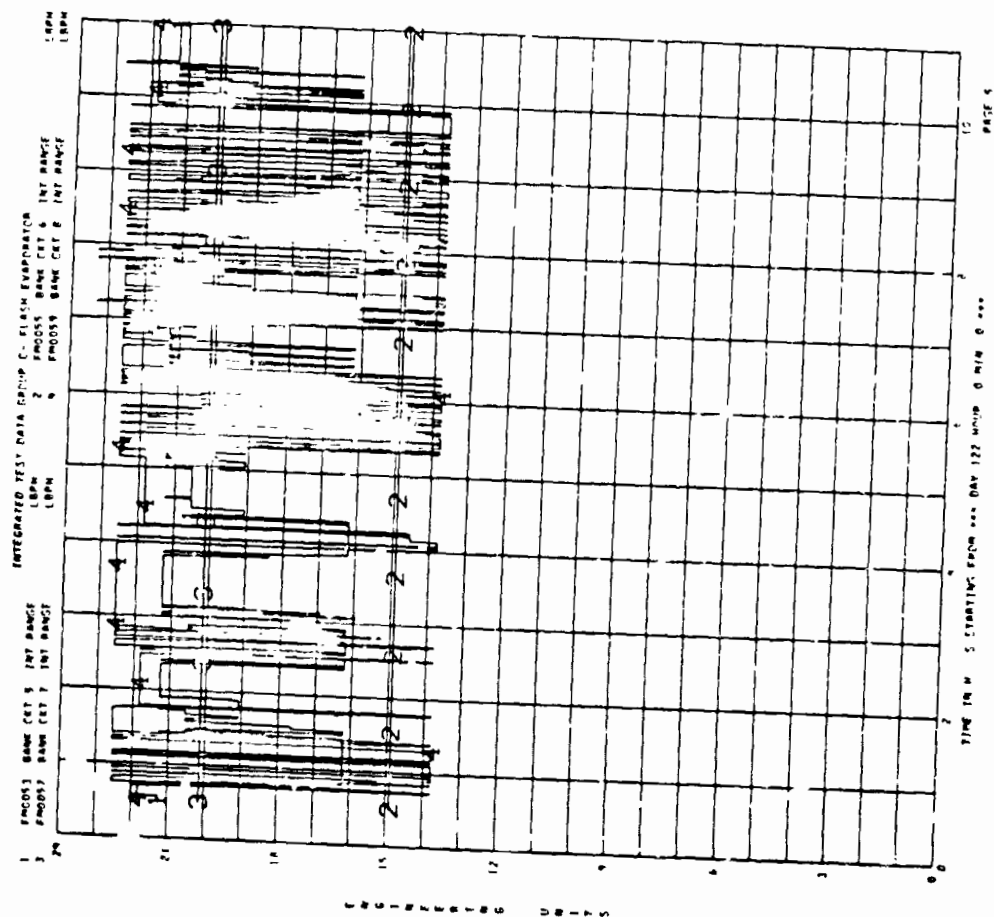
C-2



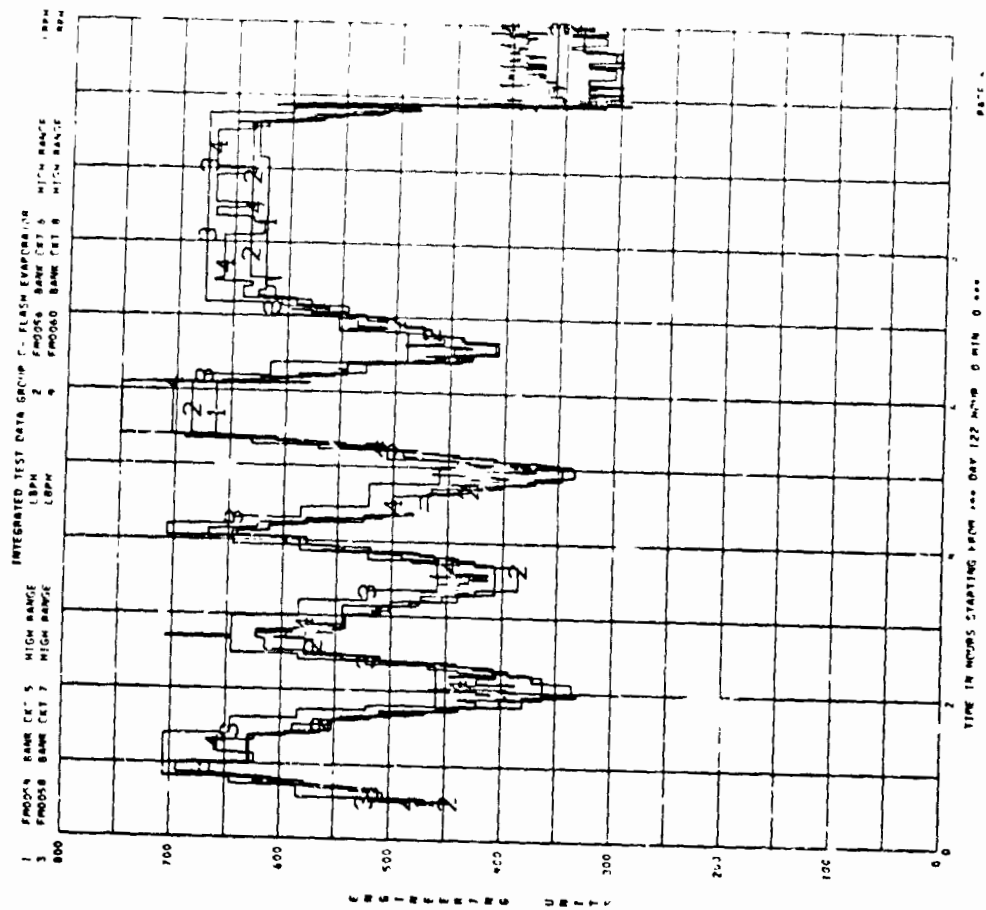
C-3



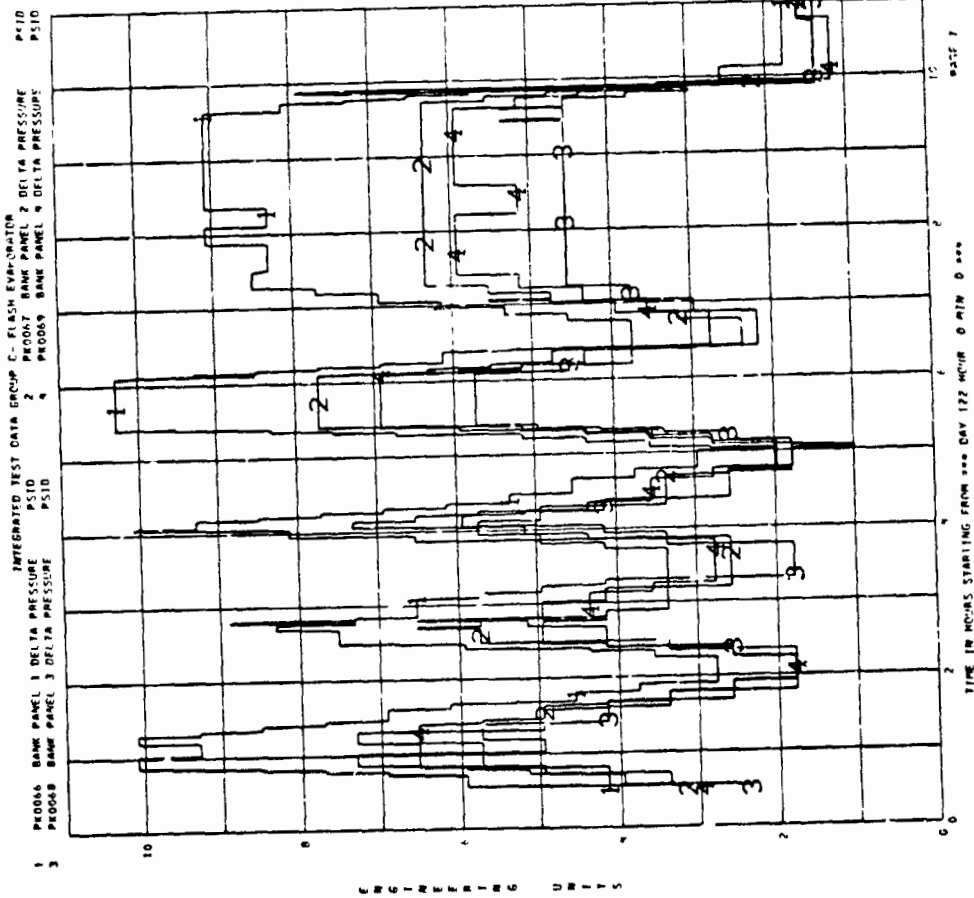
C-4



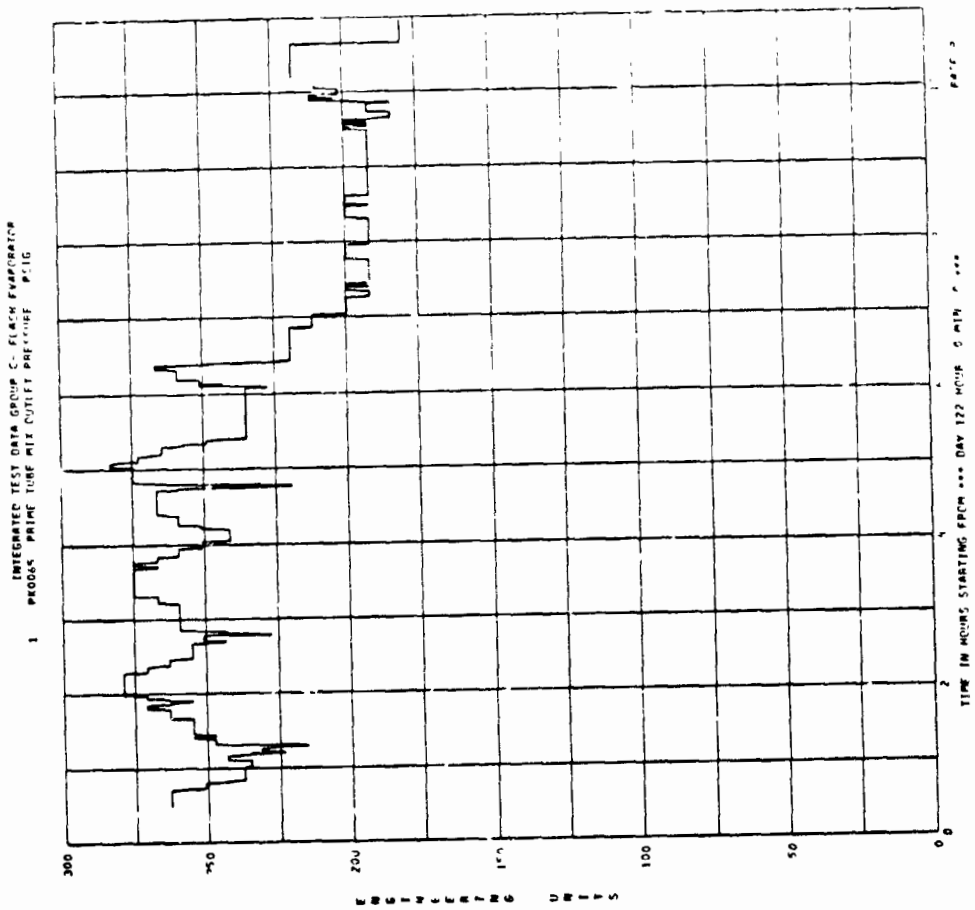
C-5



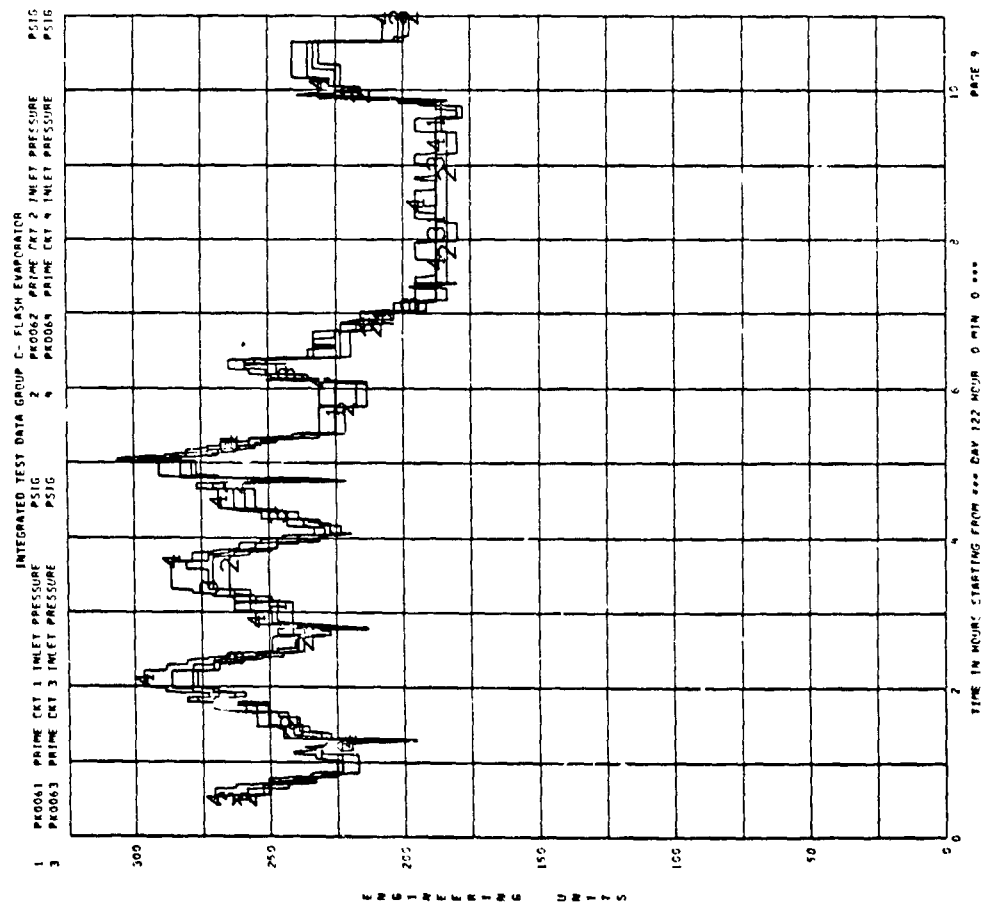
C-6



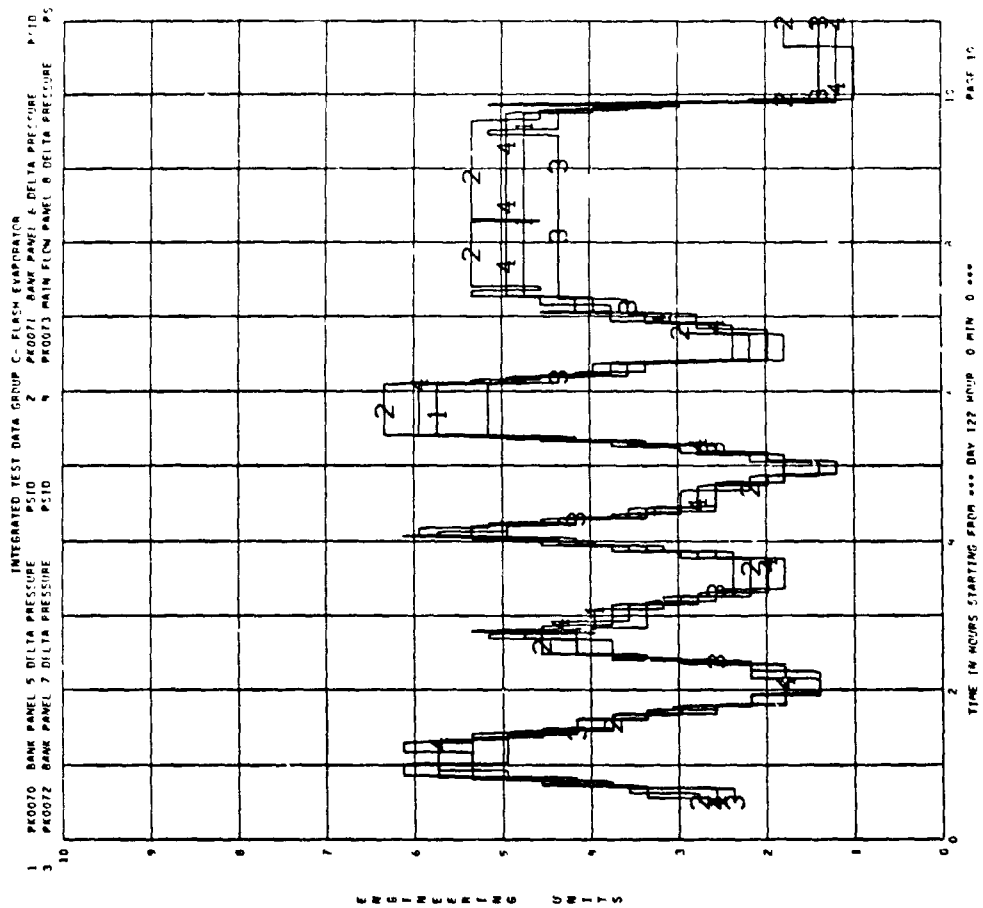
C-7



C-8



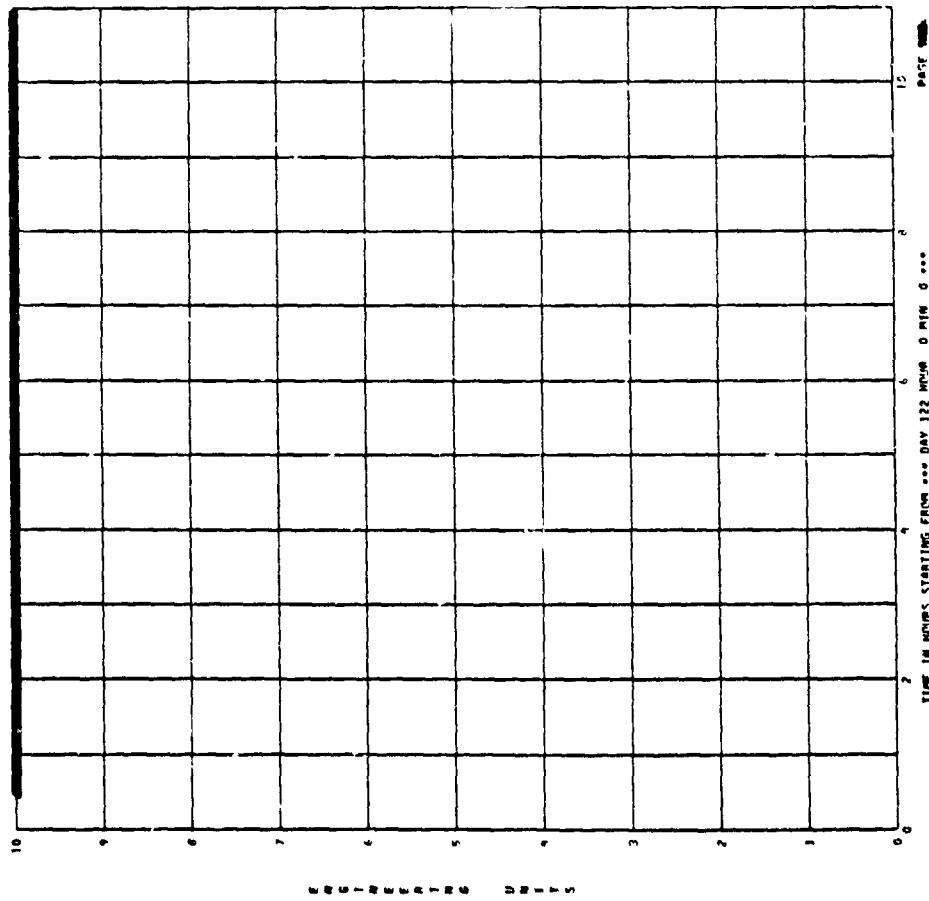
C-9



C-10

1 A10037 BAW TUBES INLET TO MIX VALVE DEG F 2 A10038 PRIME TUBES INLET TO MIX VALVE DEG

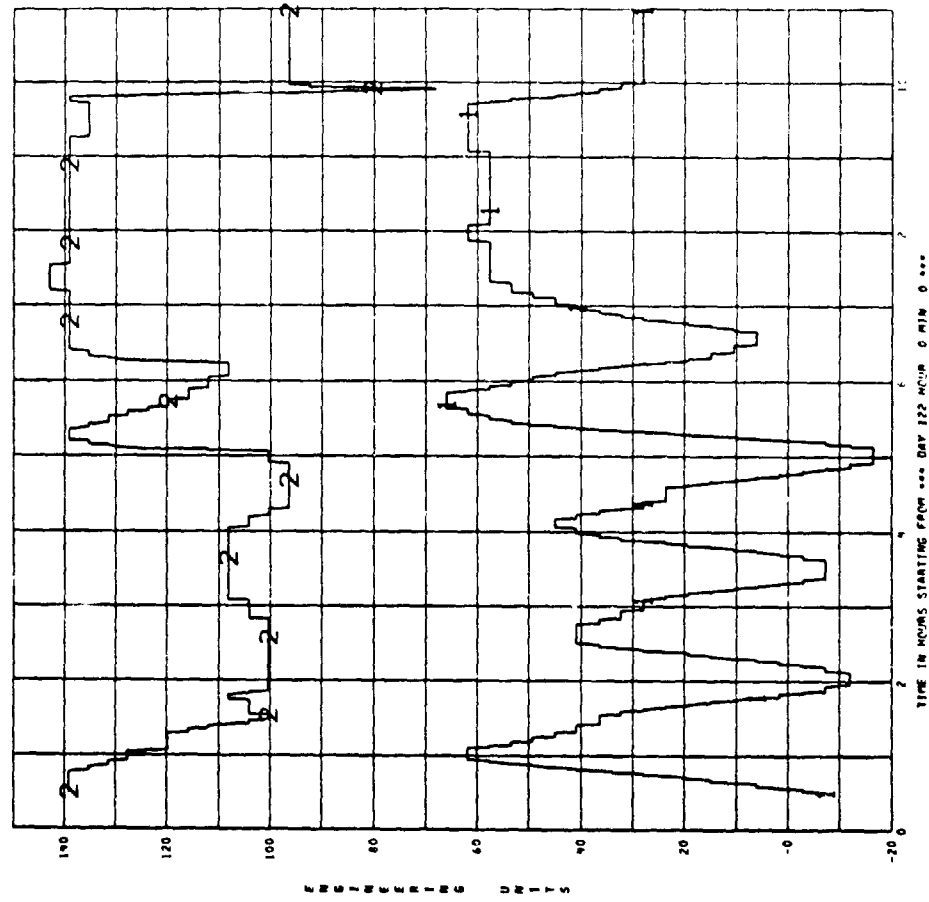
INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR



C-11

1 A10037 BAW TUBES INLET TO MIX VALVE DEG F 2 A10038 PRIME TUBES INLET TO MIX VALVE DEG

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

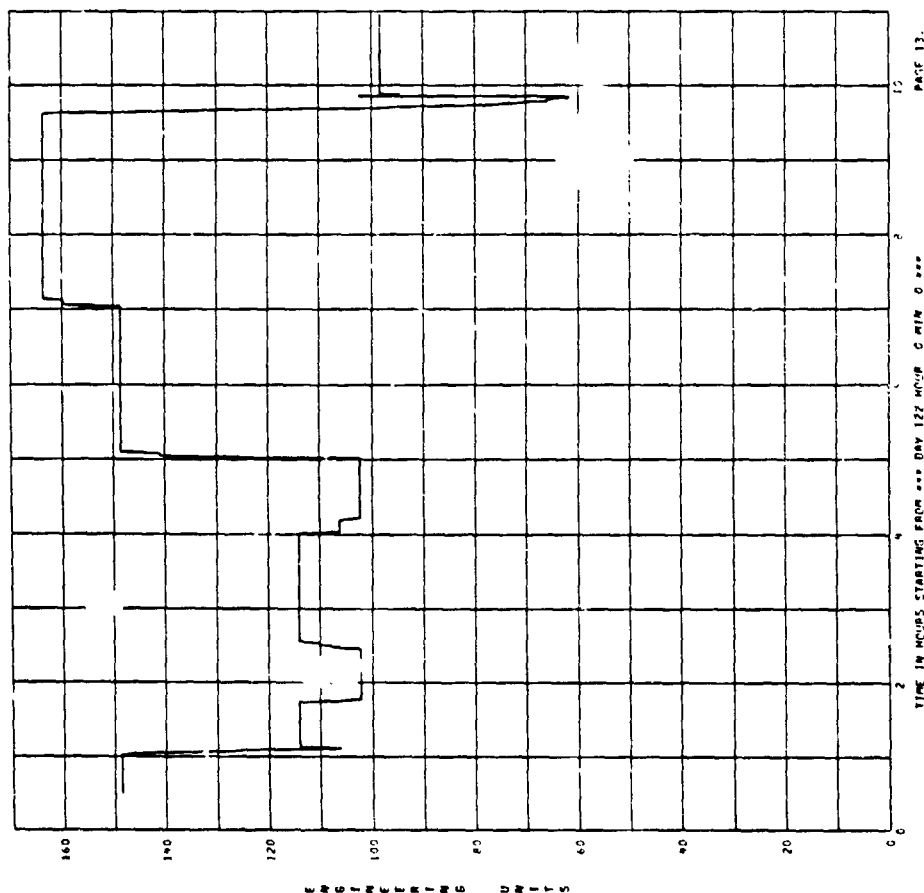


C-12

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
DES F

1

AJ0001 PRIME SYSTEM INLET



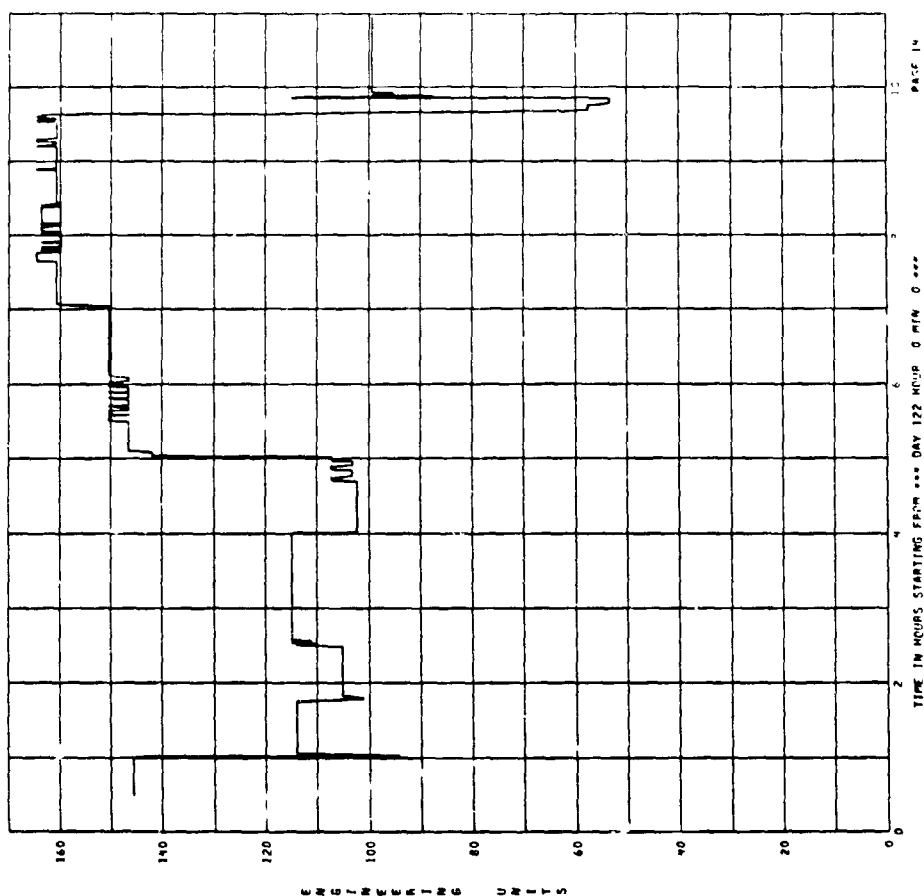
PAGE 13.

C-13

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
DES F

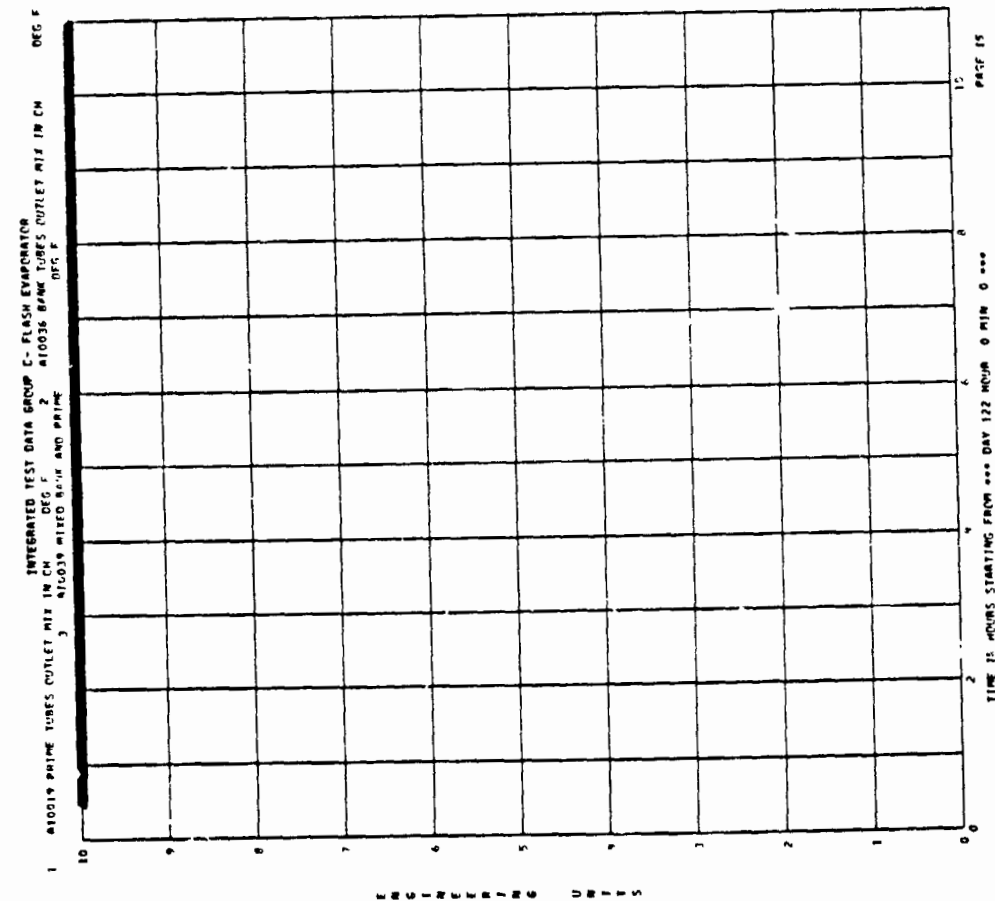
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AJ0002 BANK SYSTEM INLET

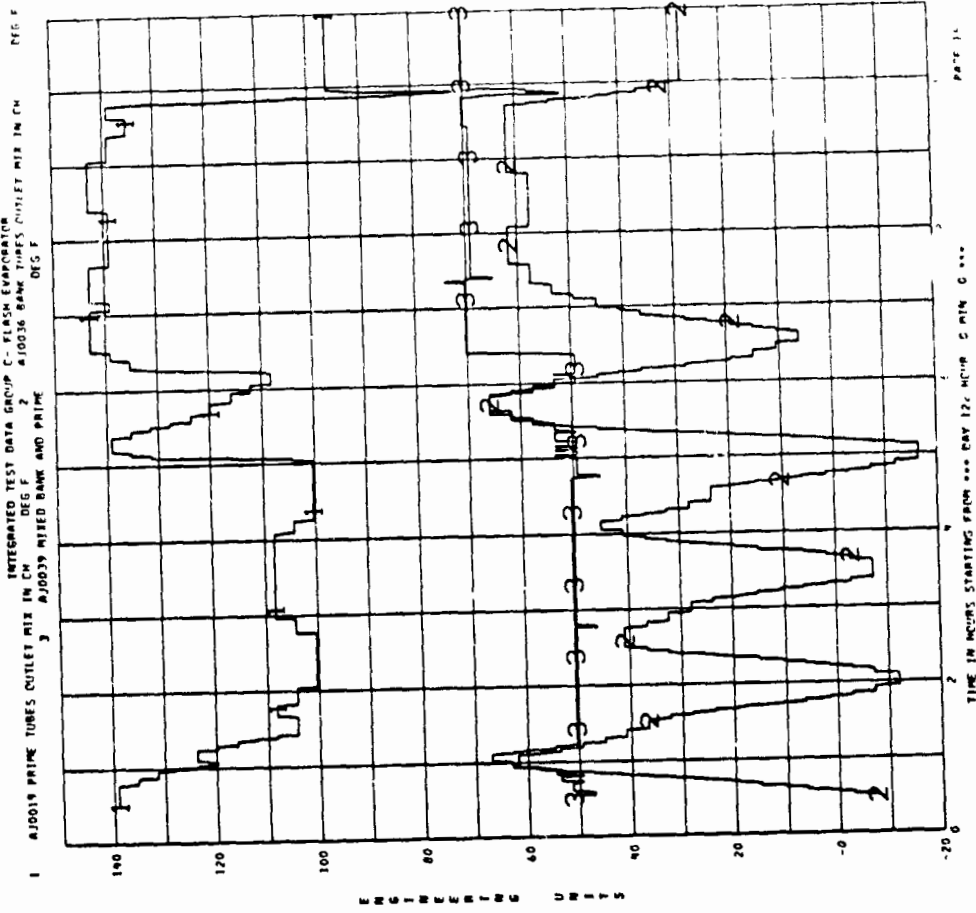


PAGE 14

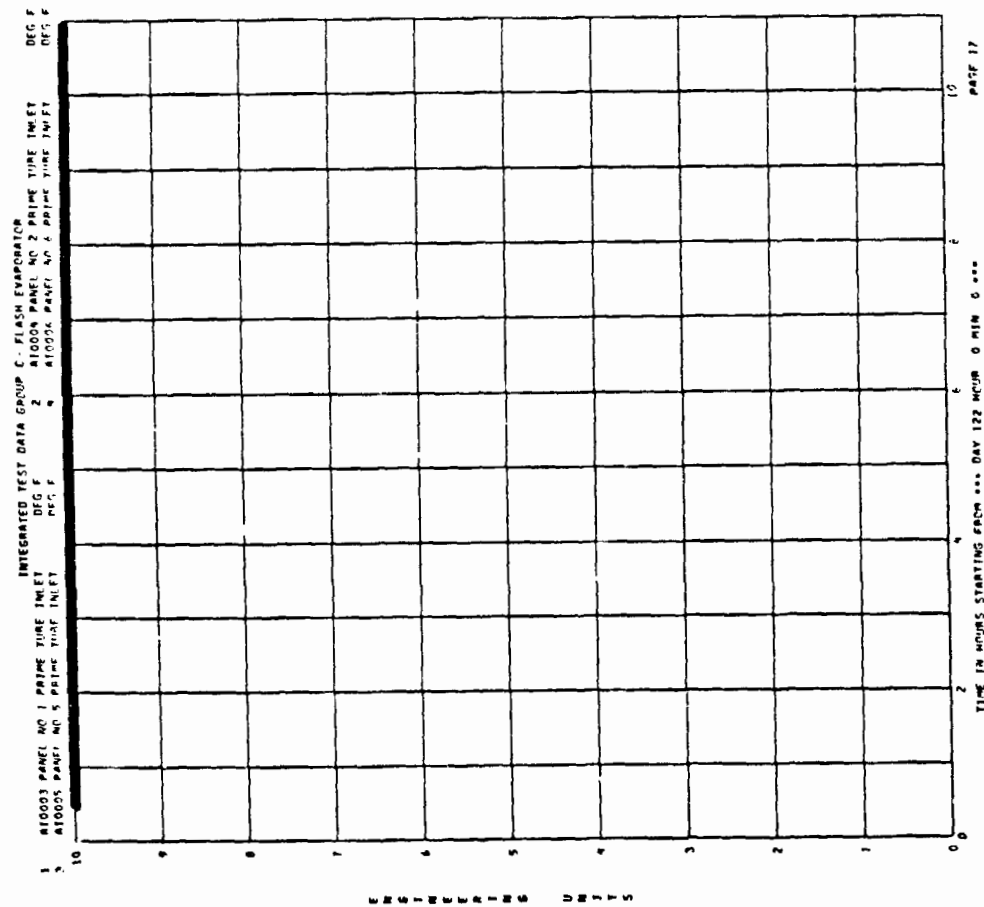
C-14



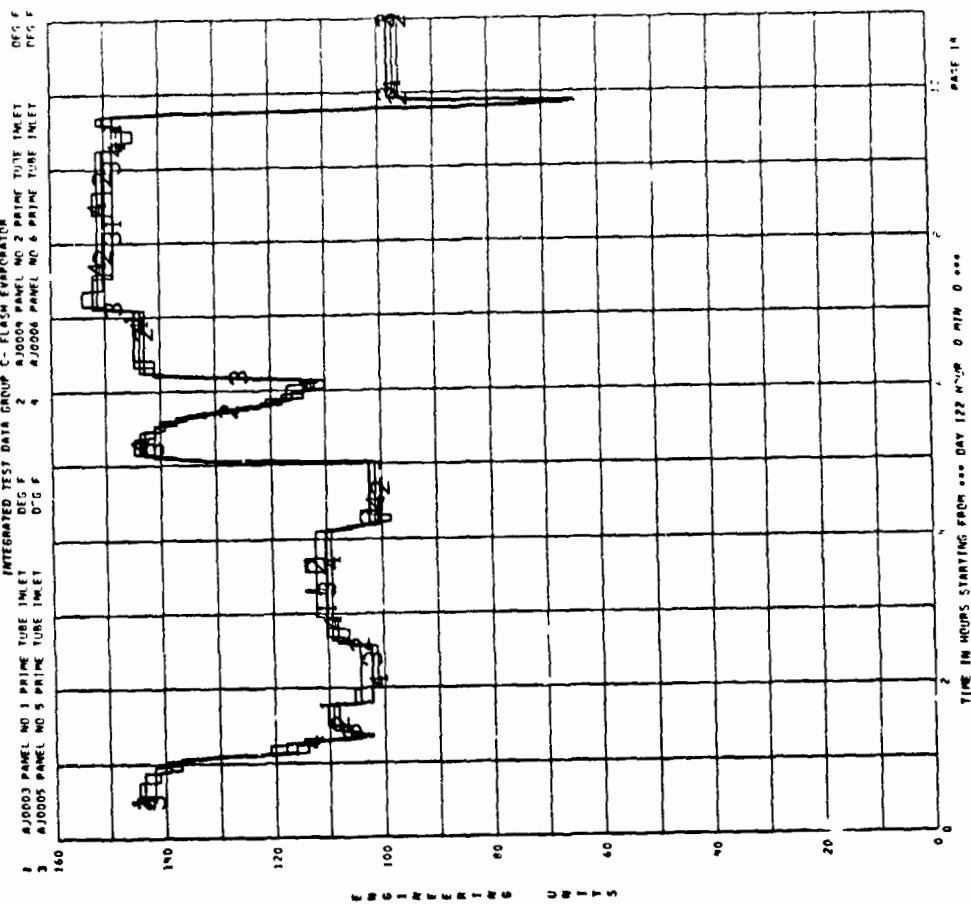
C-15



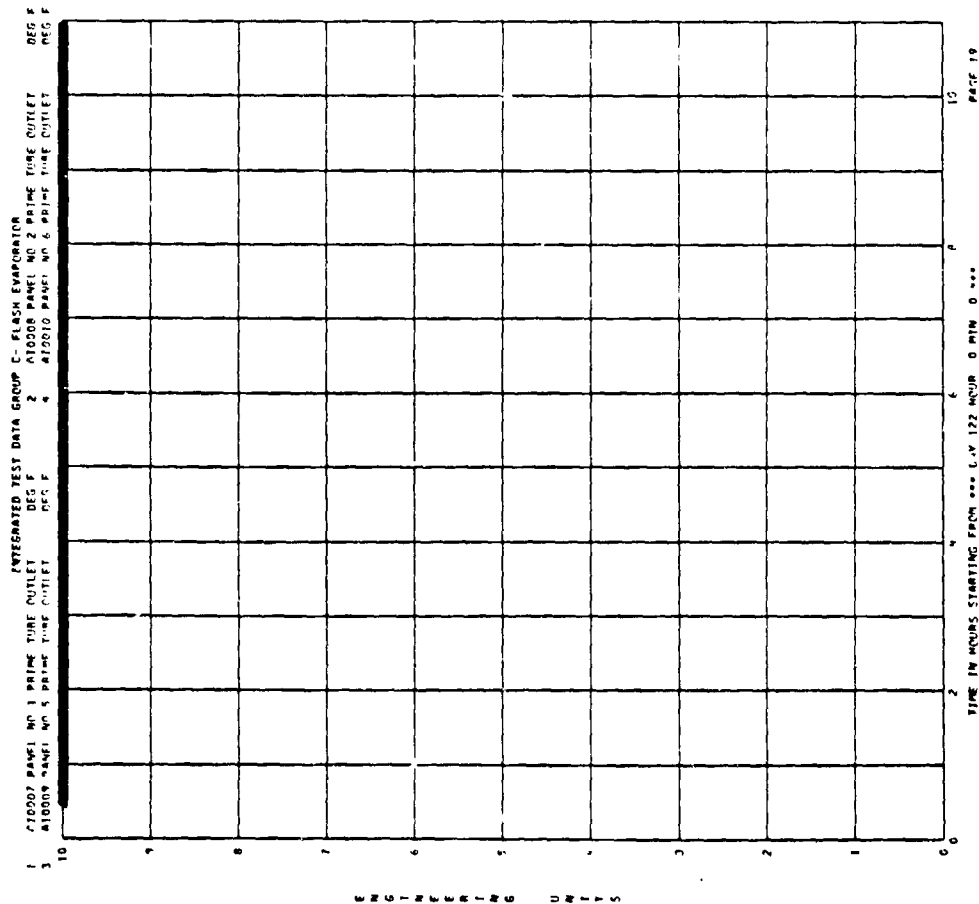
C-16



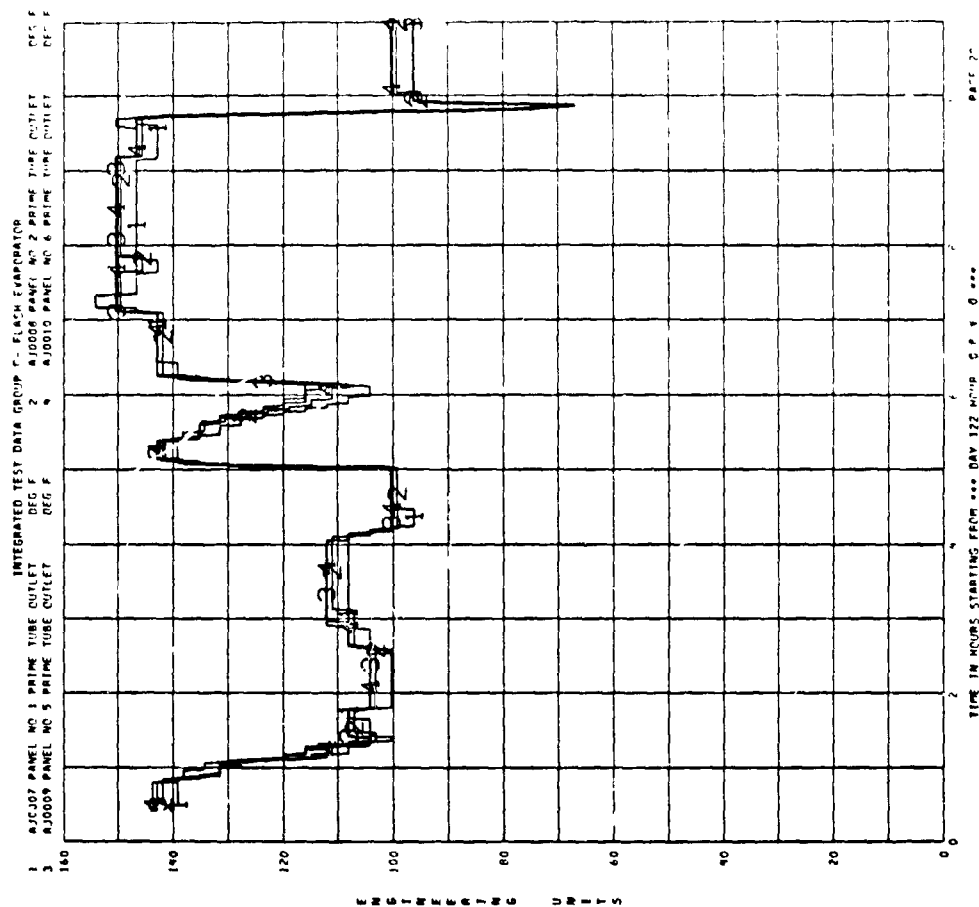
C-17



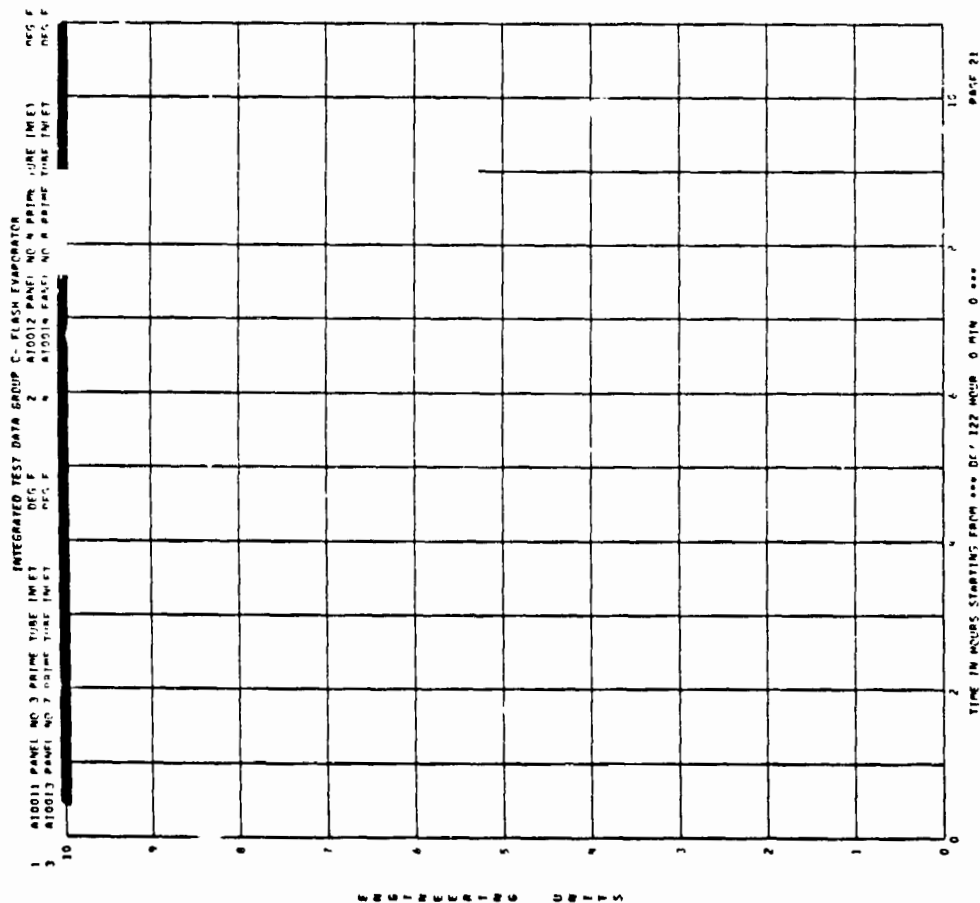
C-18



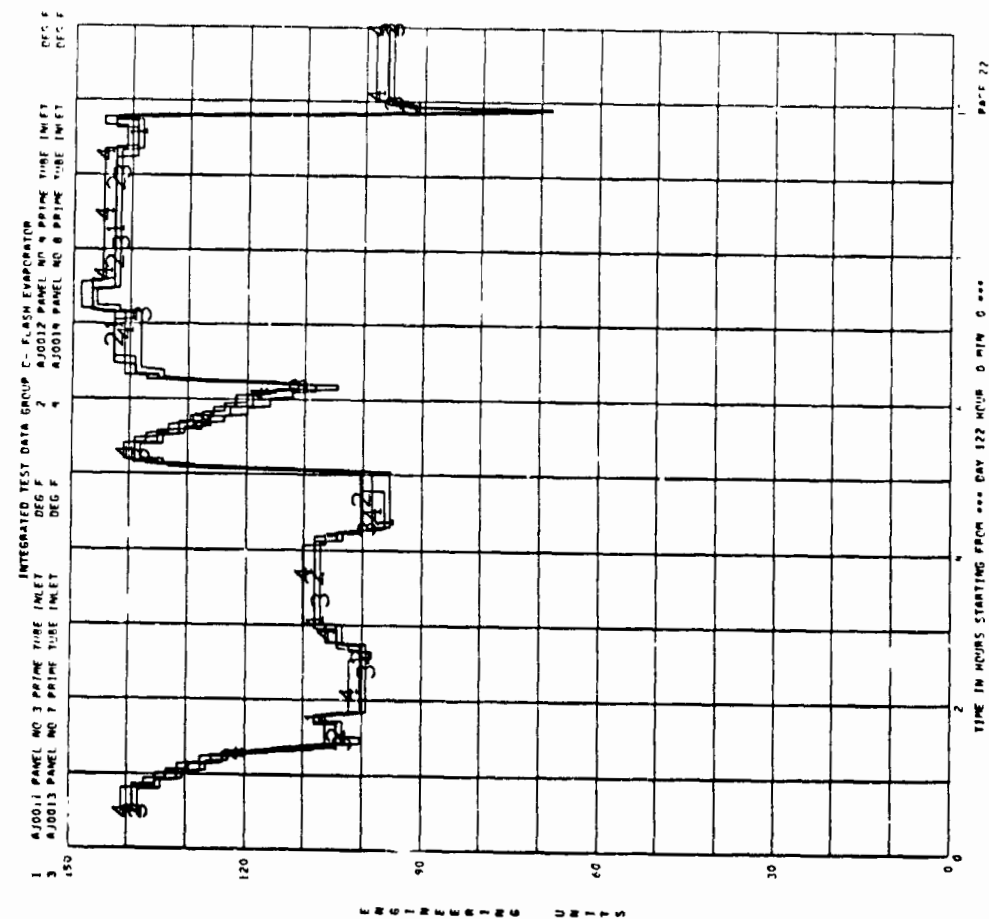
C-19



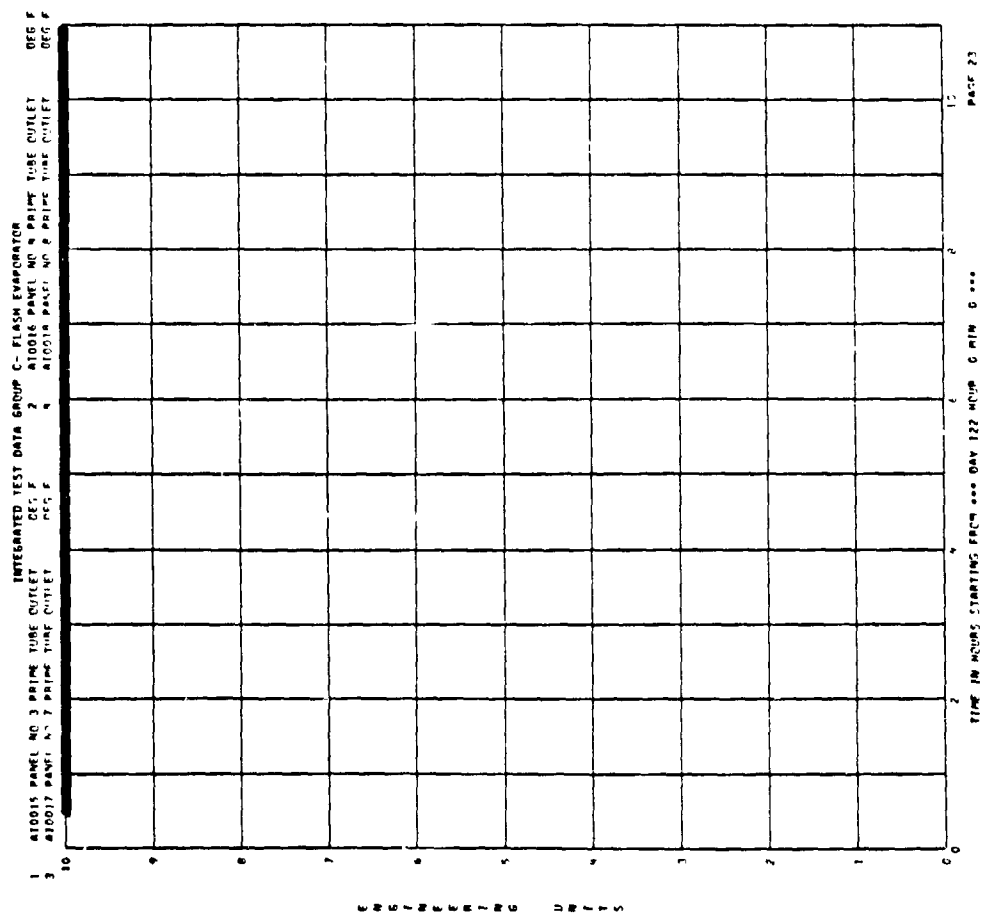
C-20



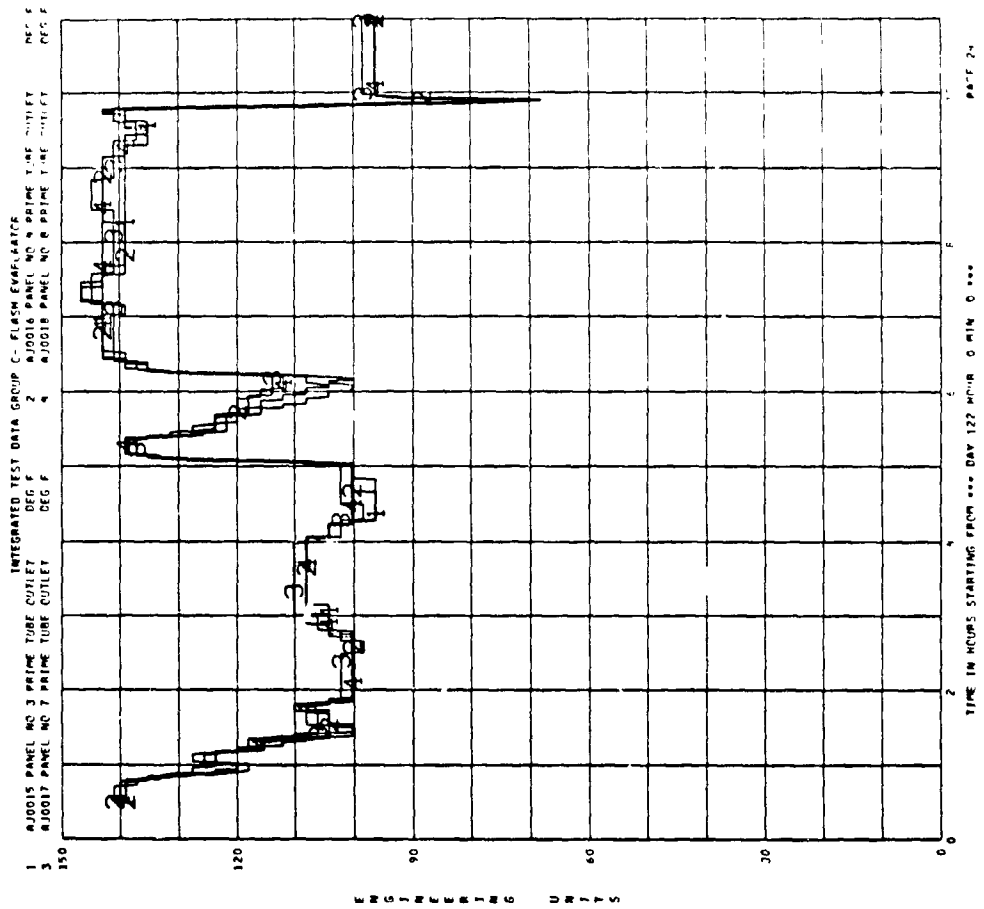
C-21



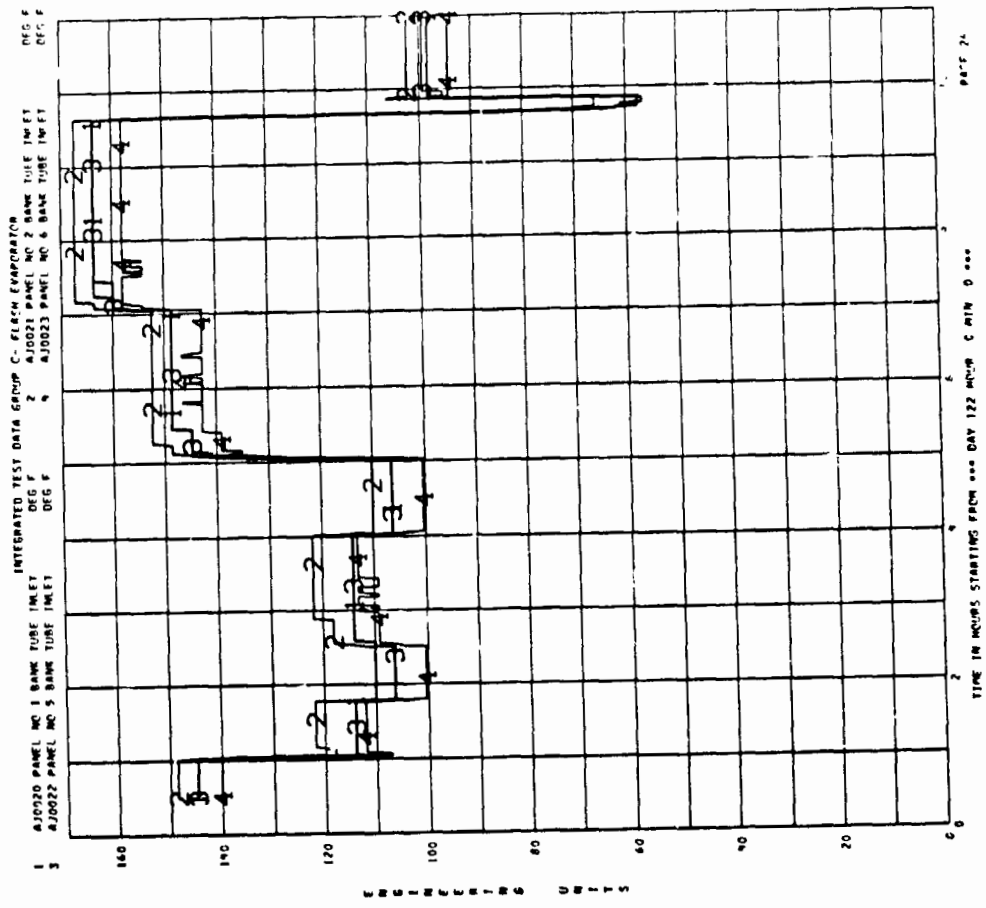
C-22



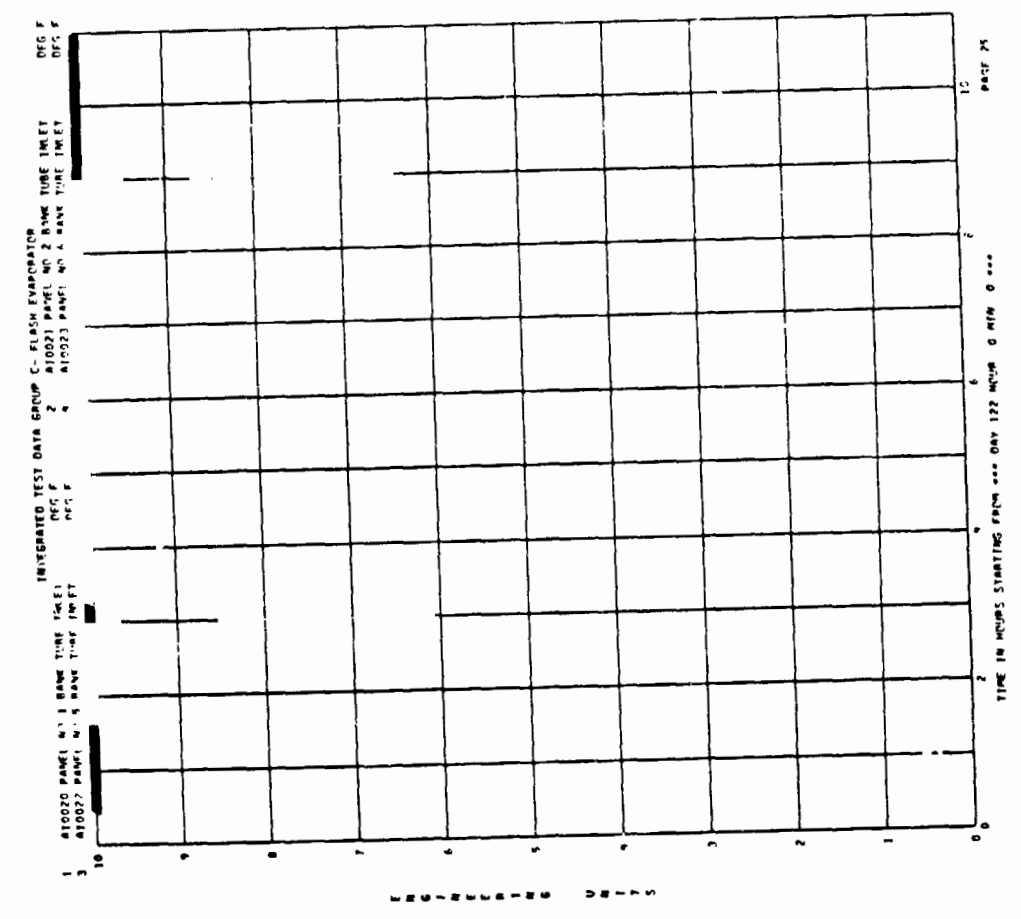
C-23



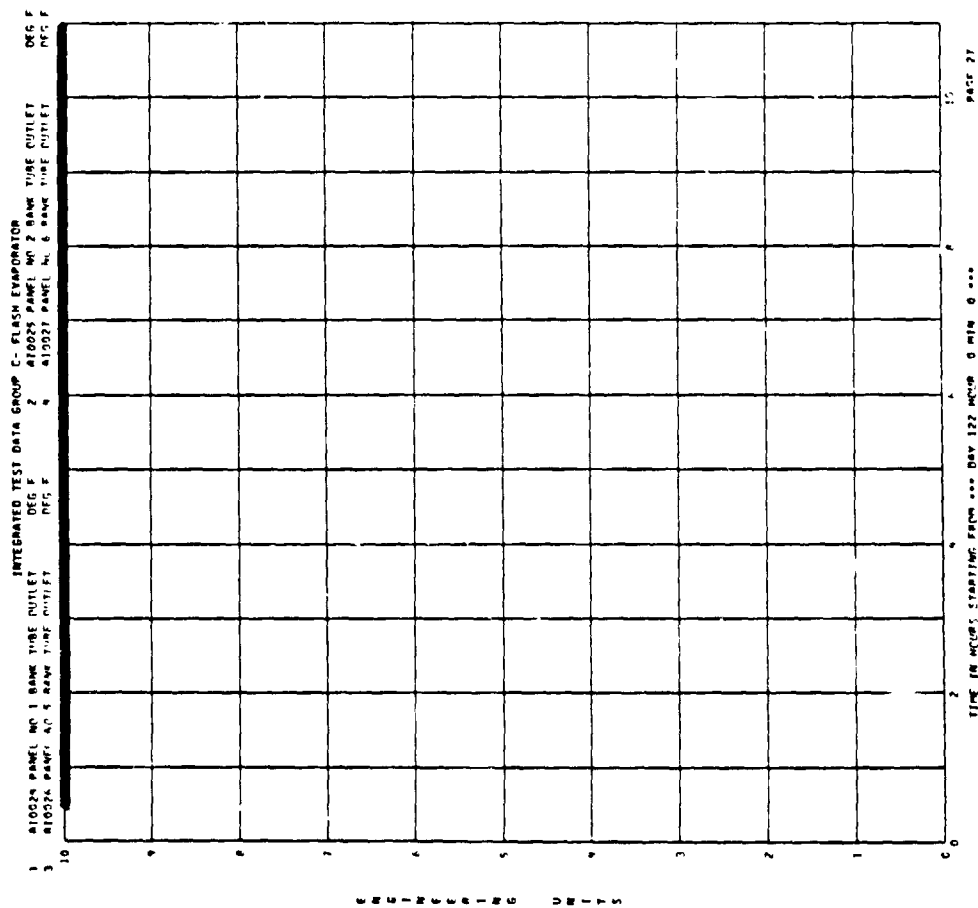
C-24



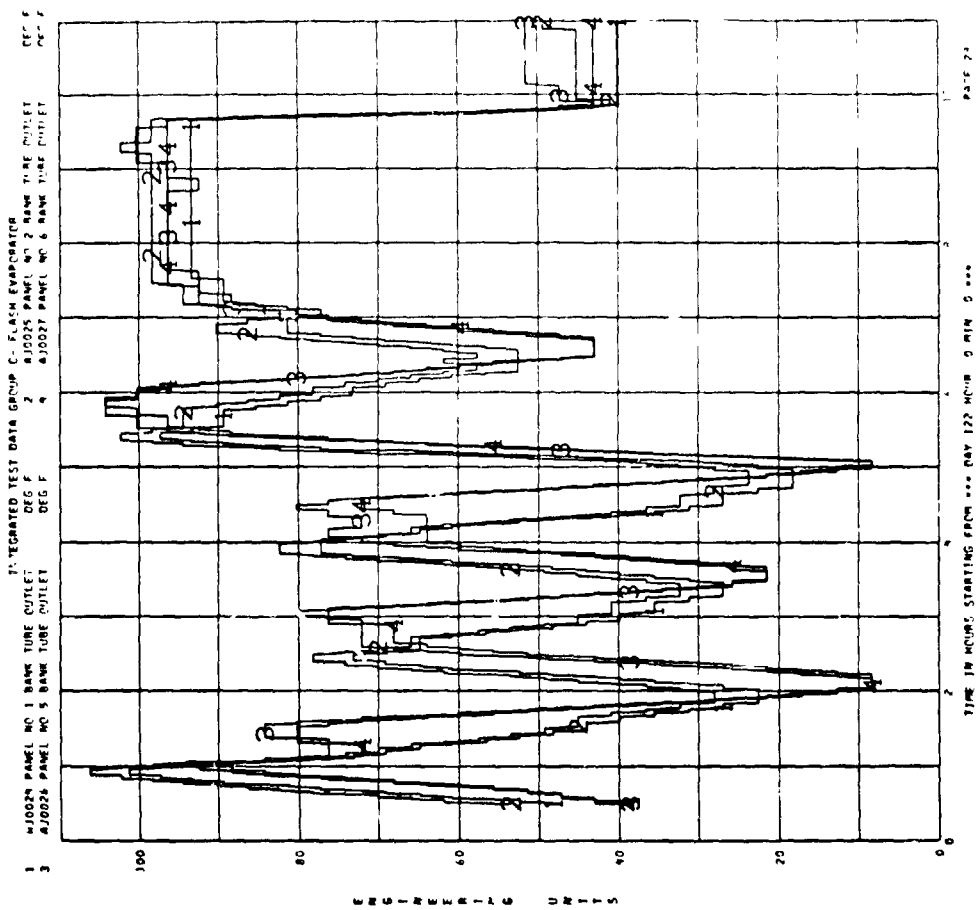
C-26



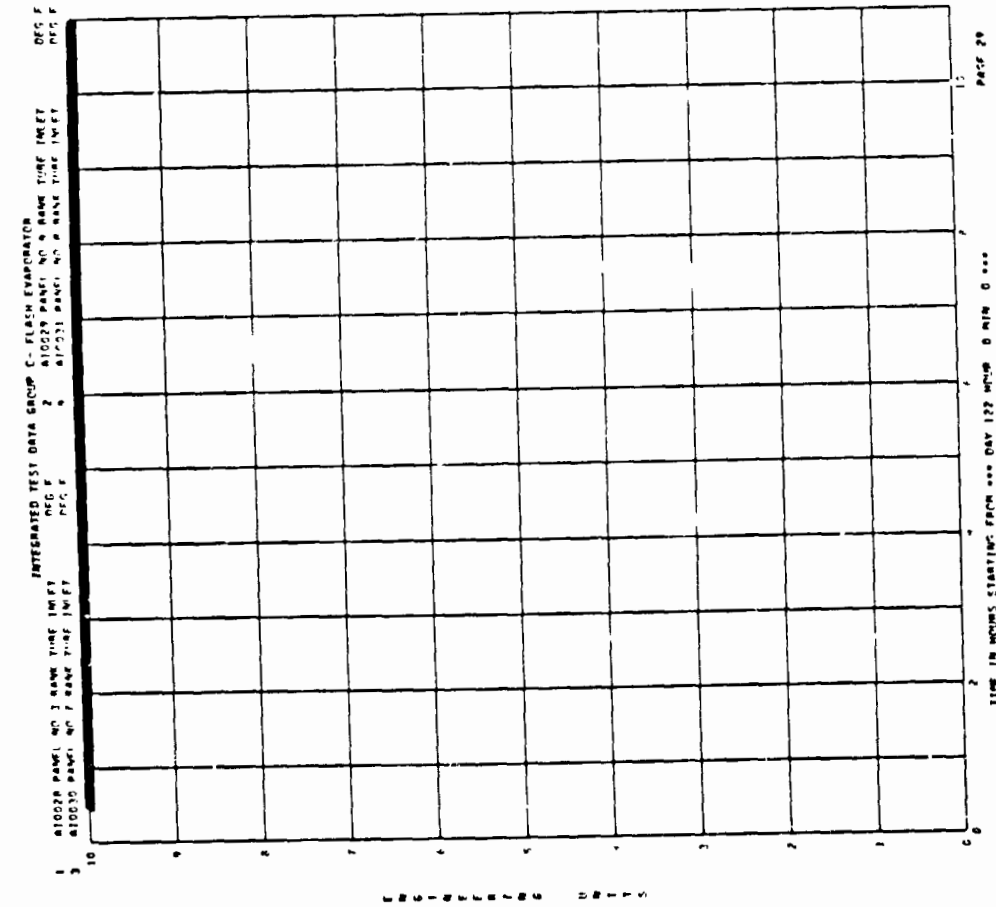
C-25



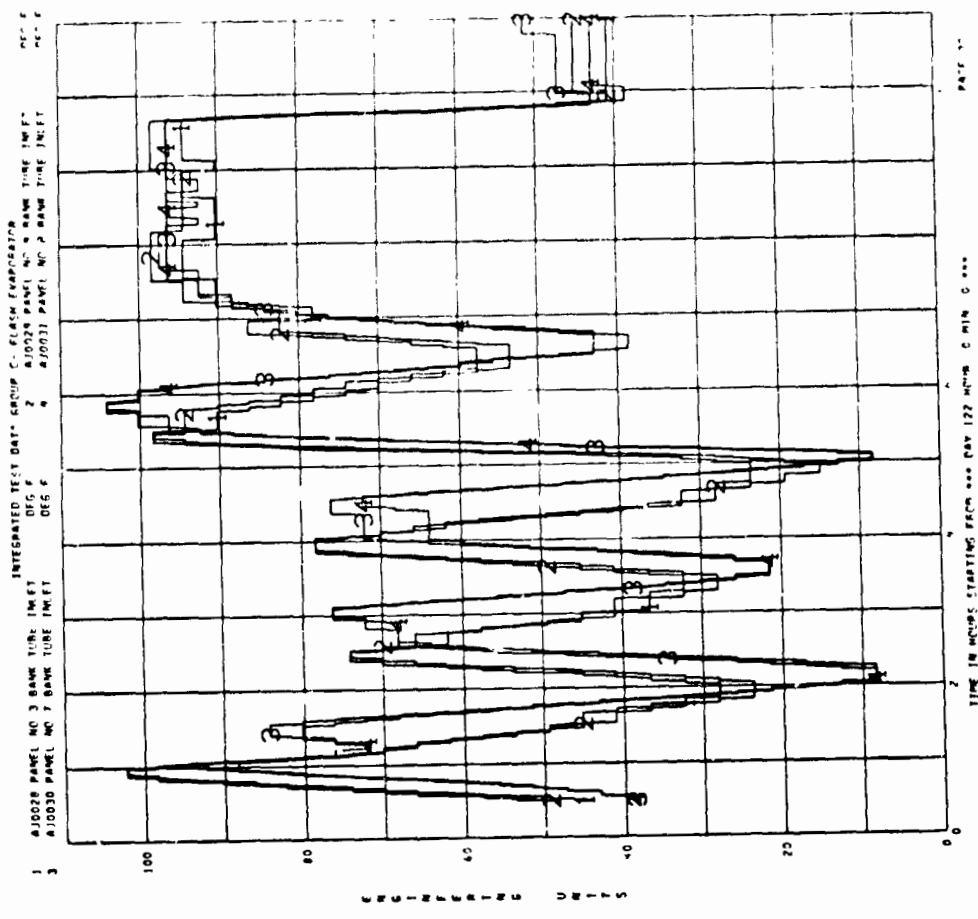
C-27



C-28

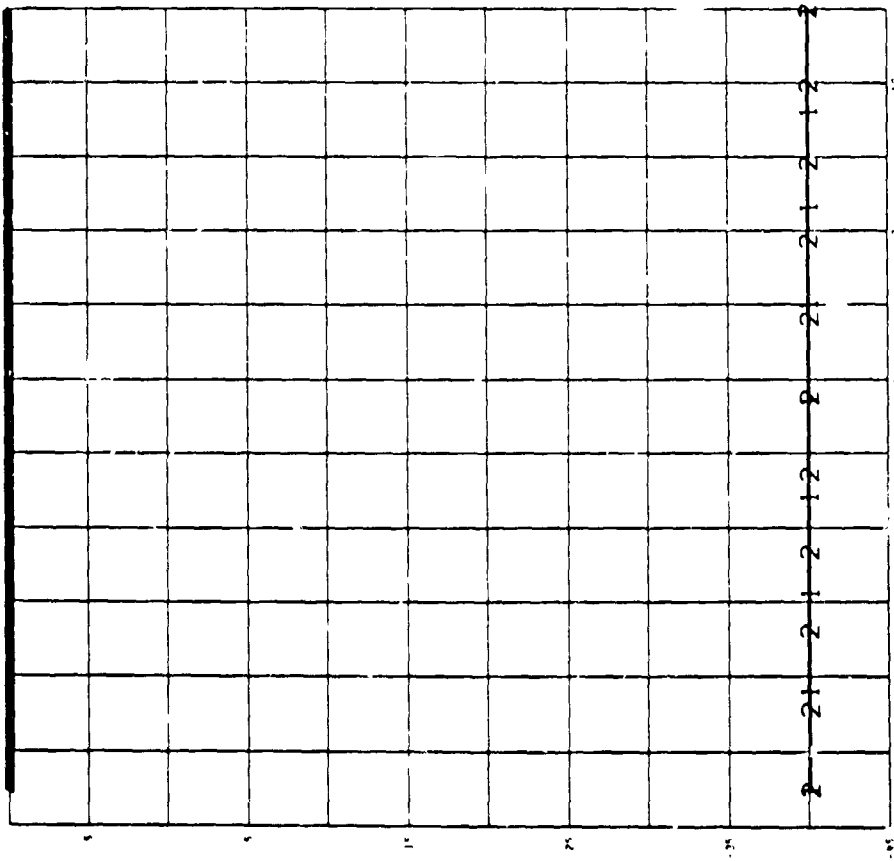


C-29



C-30

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATION
 1. 810032 PANEL NO 3 BANK TIME OUTLET DEC 8 1955
 2. 810033 PANEL NO 4 BANK TIME OUTLET DEC 8 1955
 3. 810034 PANEL NO 5 BANK TIME OUTLET DEC 8 1955

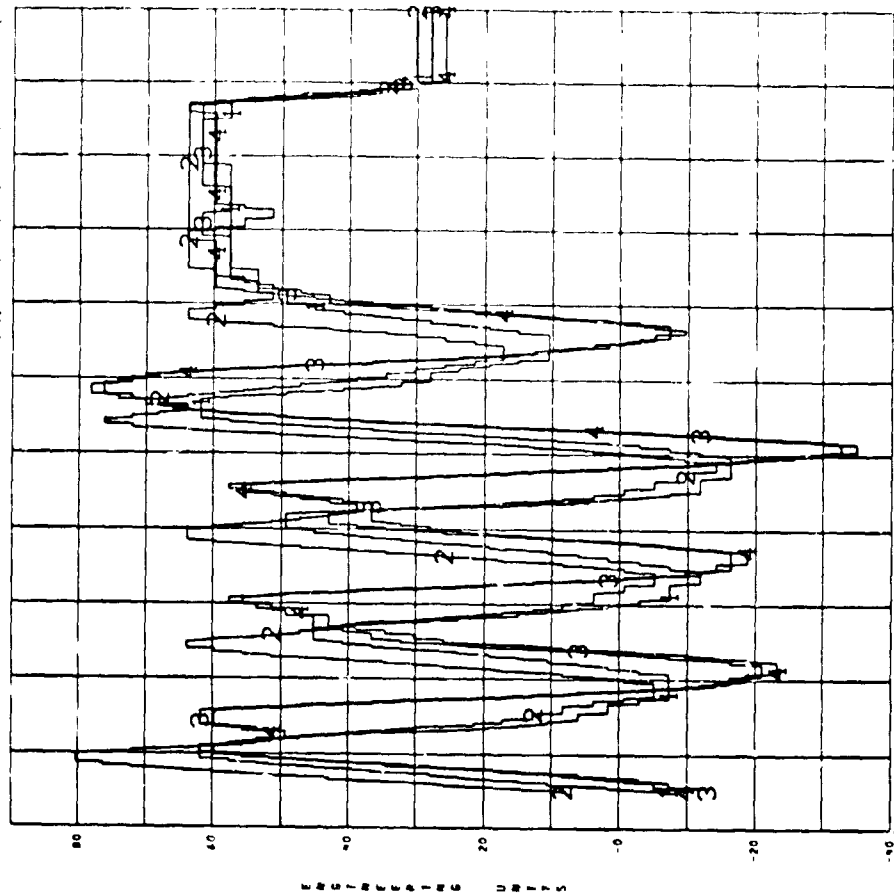


TIME IN HOURS STARTING FROM 0000 HRS 0 MIN 0 SEC

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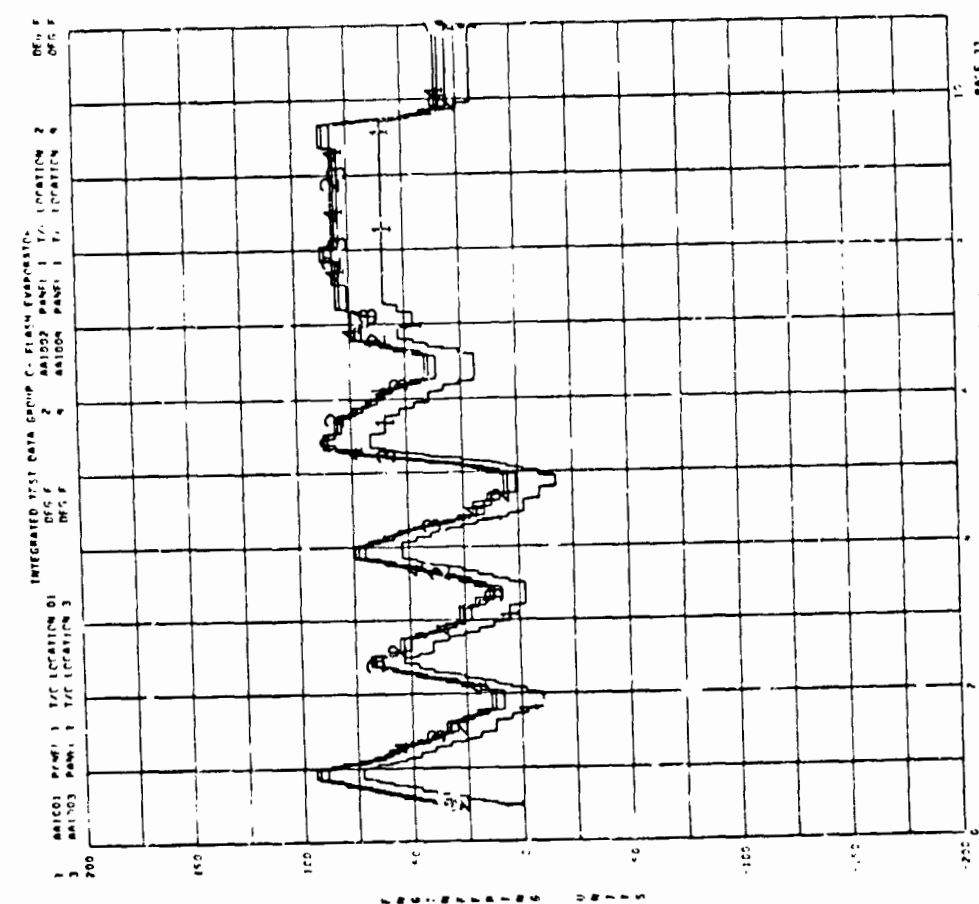
INTEGRATED TEST DATA GROUP C- FLASH EVAPORATION
 1. 810032 PANEL NO 3 BANK TIME OUTLET DEC 8 1955
 2. 810033 PANEL NO 4 BANK TIME OUTLET DEC 8 1955
 3. 810034 PANEL NO 5 BANK TIME OUTLET DEC 8 1955



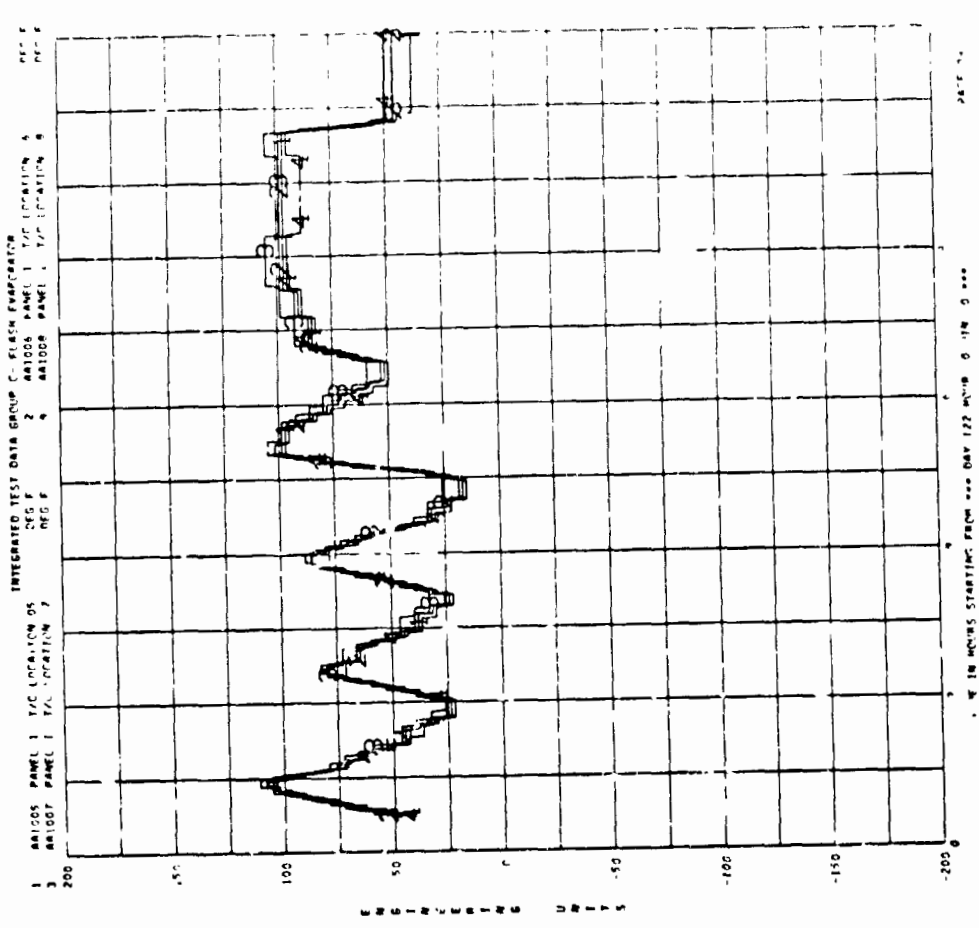
TIME IN HOURS STARTING FROM 0000 HRS 0 MIN 0 SEC

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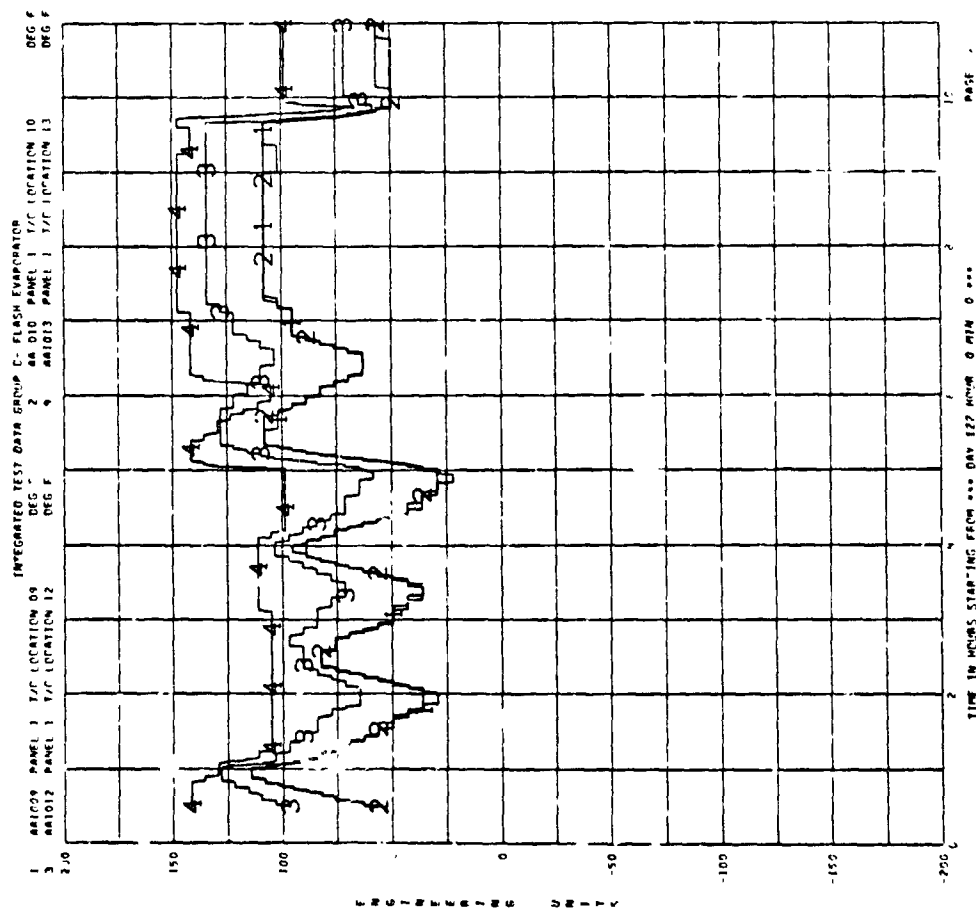
C-32



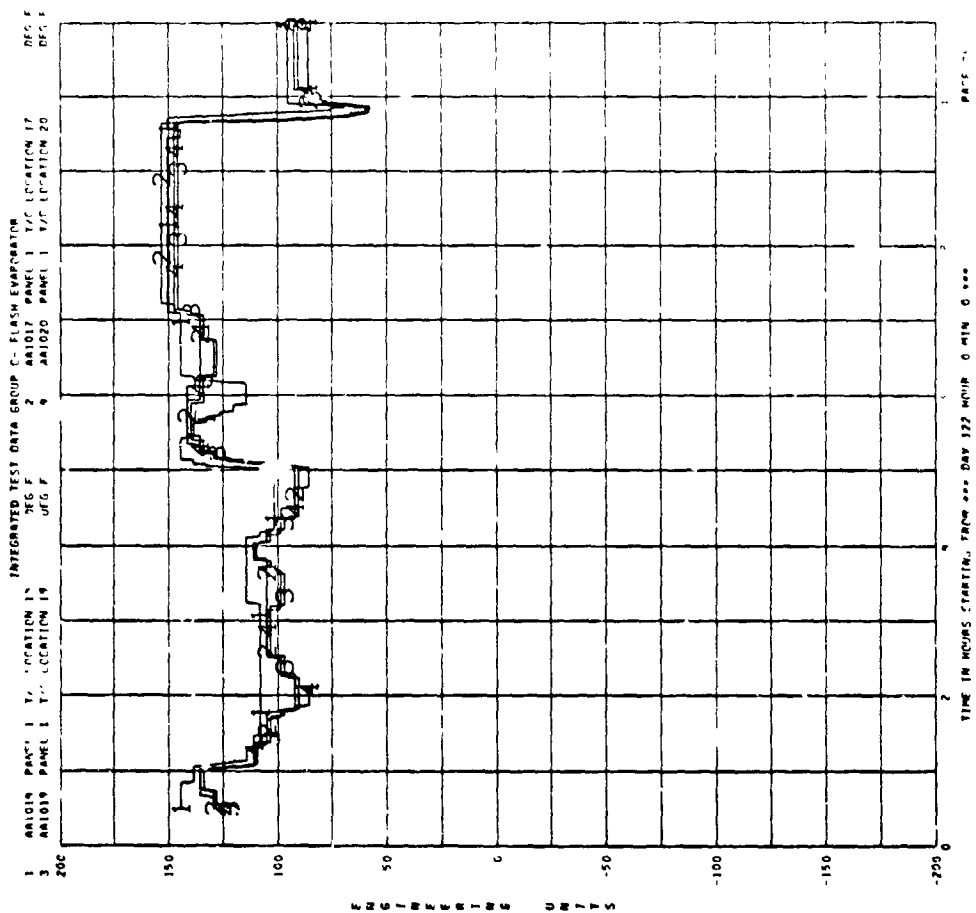
C-33



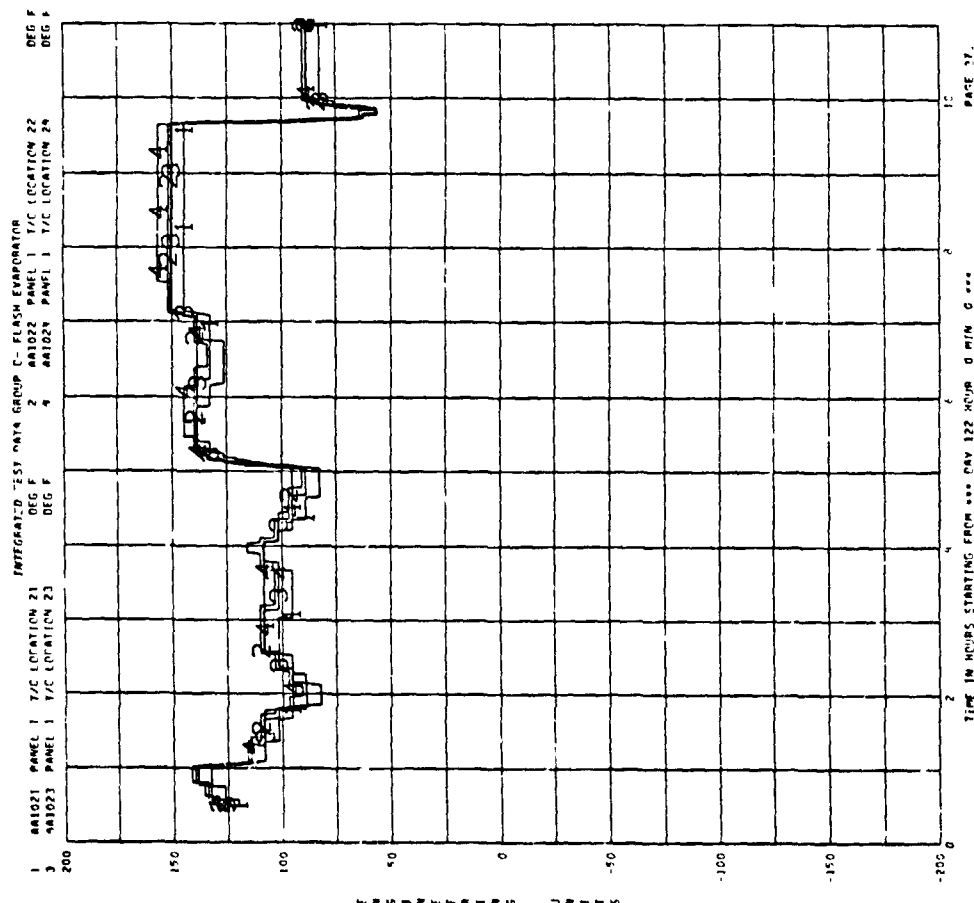
C-34



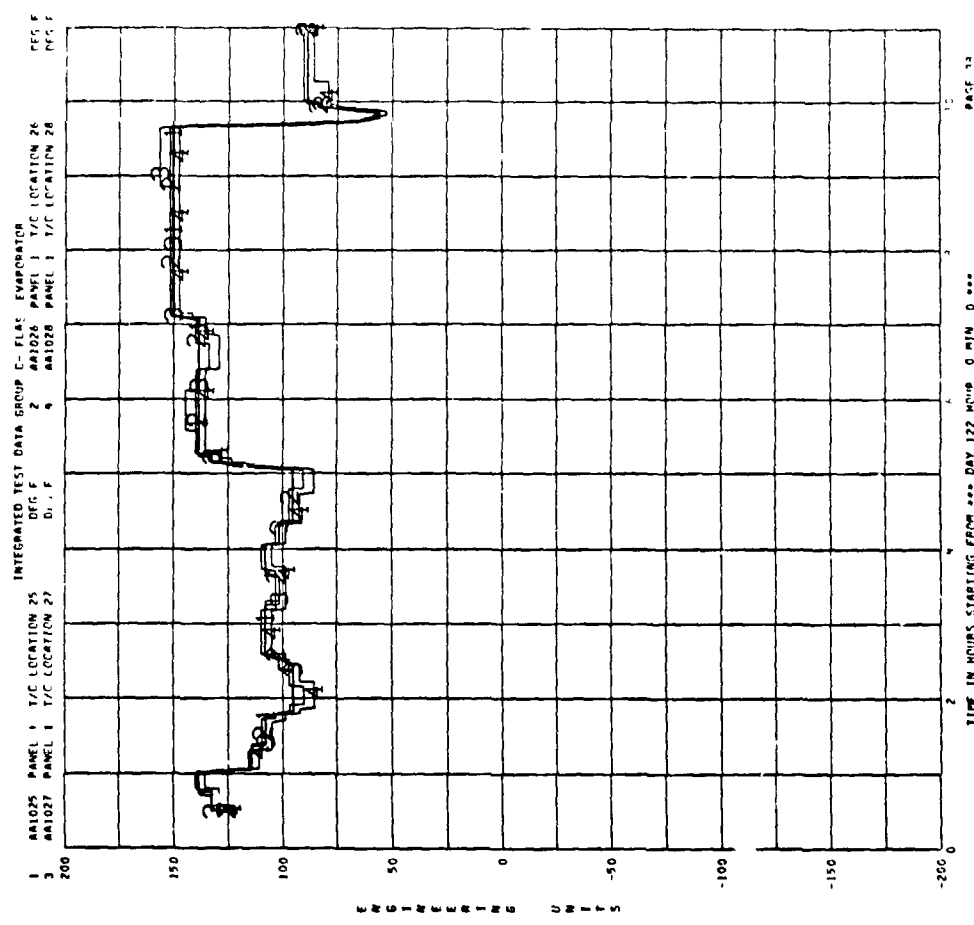
C-35



C-36



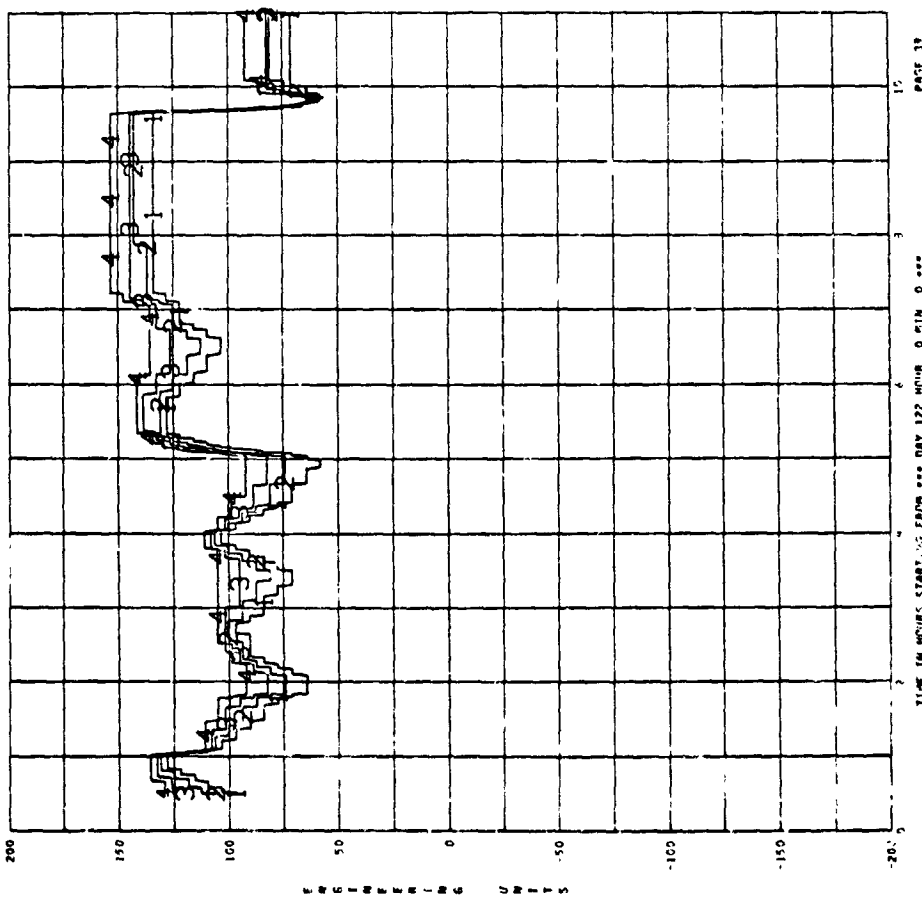
C-37



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INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

1 001012 PANEL 1 T/C LOCATION 12 DEG F 2 001015 PANEL 1 T/C LOCATION 15 DEG F
3 001016 PANEL 1 T/C LOCATION 1 DEG F 4 001017 PANEL 1 T/C LOCATION 17 DEG F

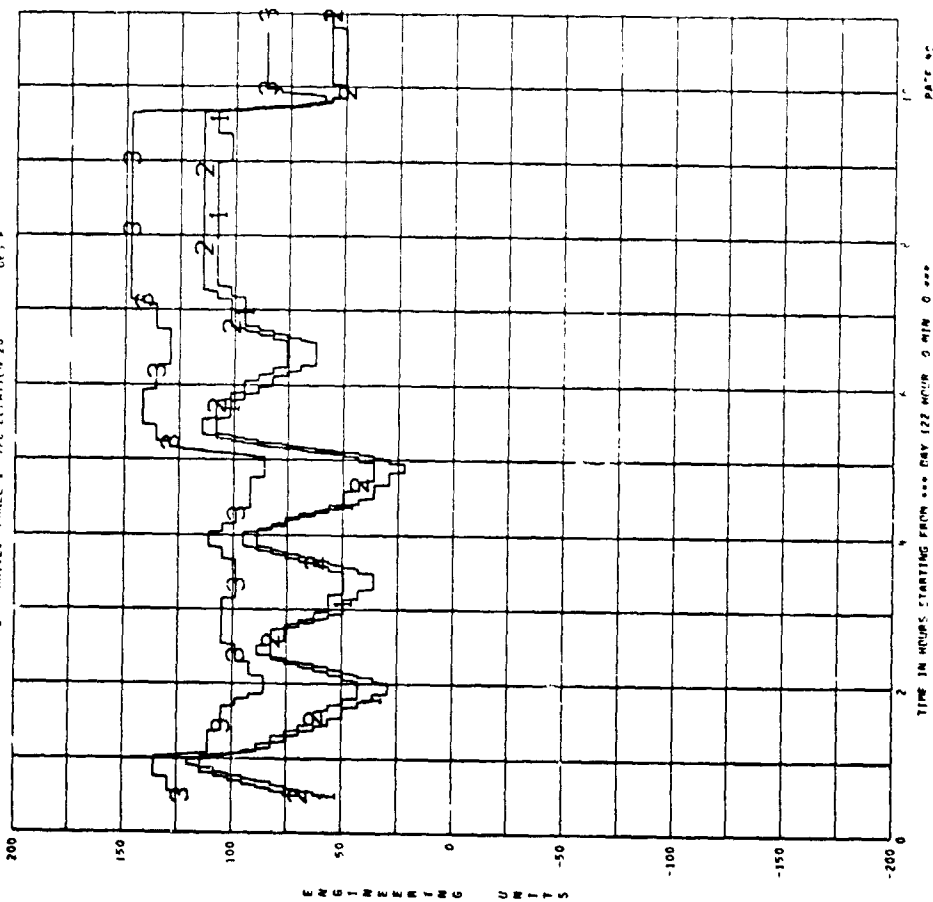


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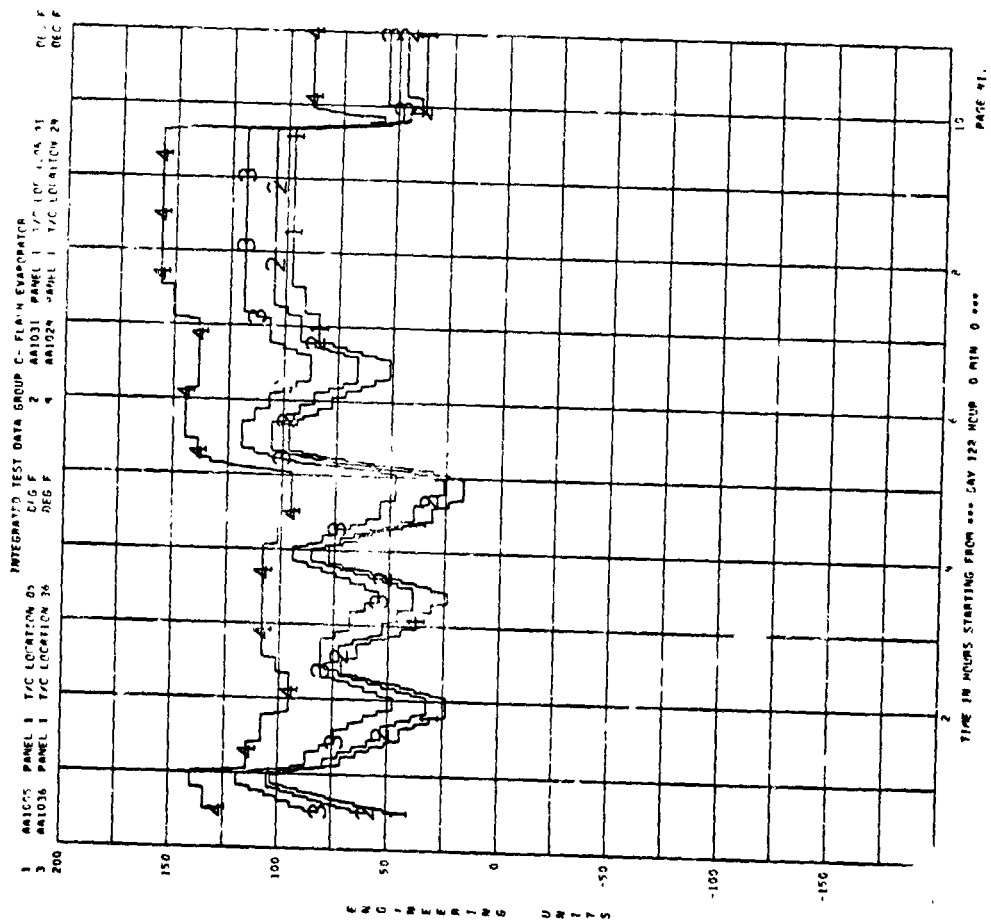
INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

1 001009 PANEL 1 T/C LOCATION 09 DEG F 2 001010 PANEL 1 T/C LOCATION 10 DEG F
3 001020 PANEL 3 T/C LOCATION 20 DEG F



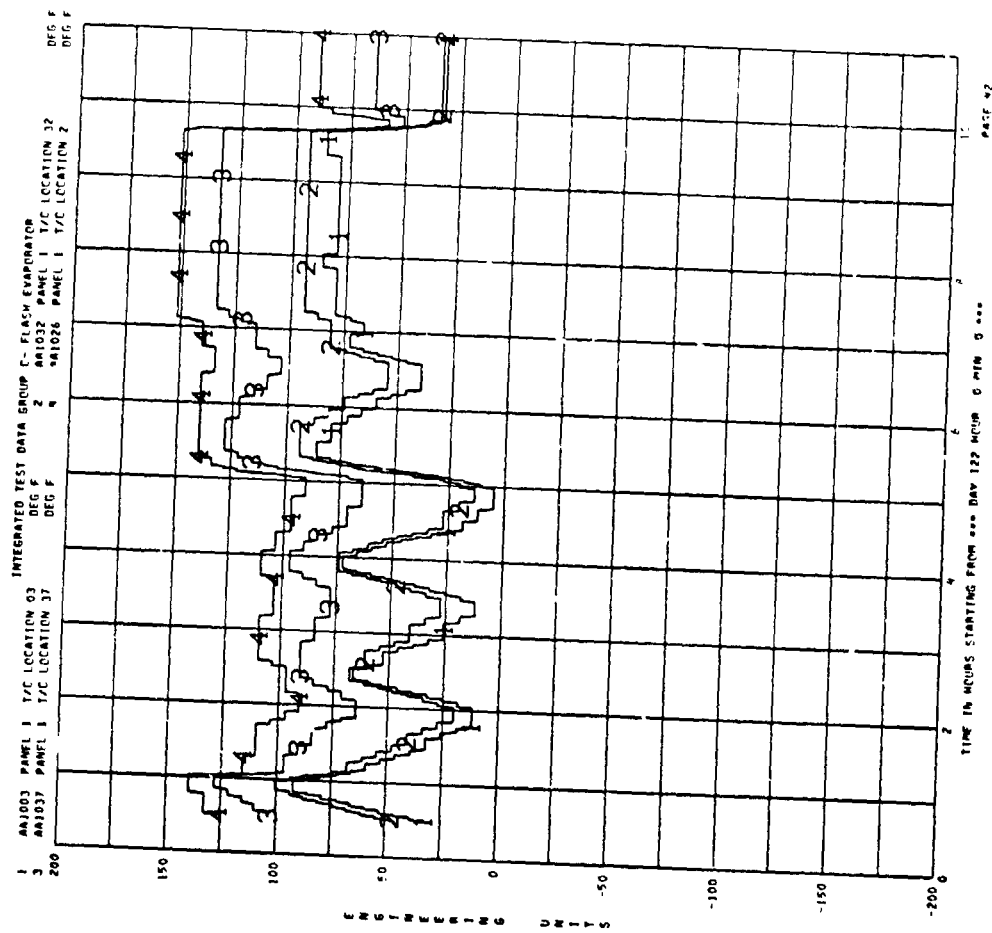
PAGE 40

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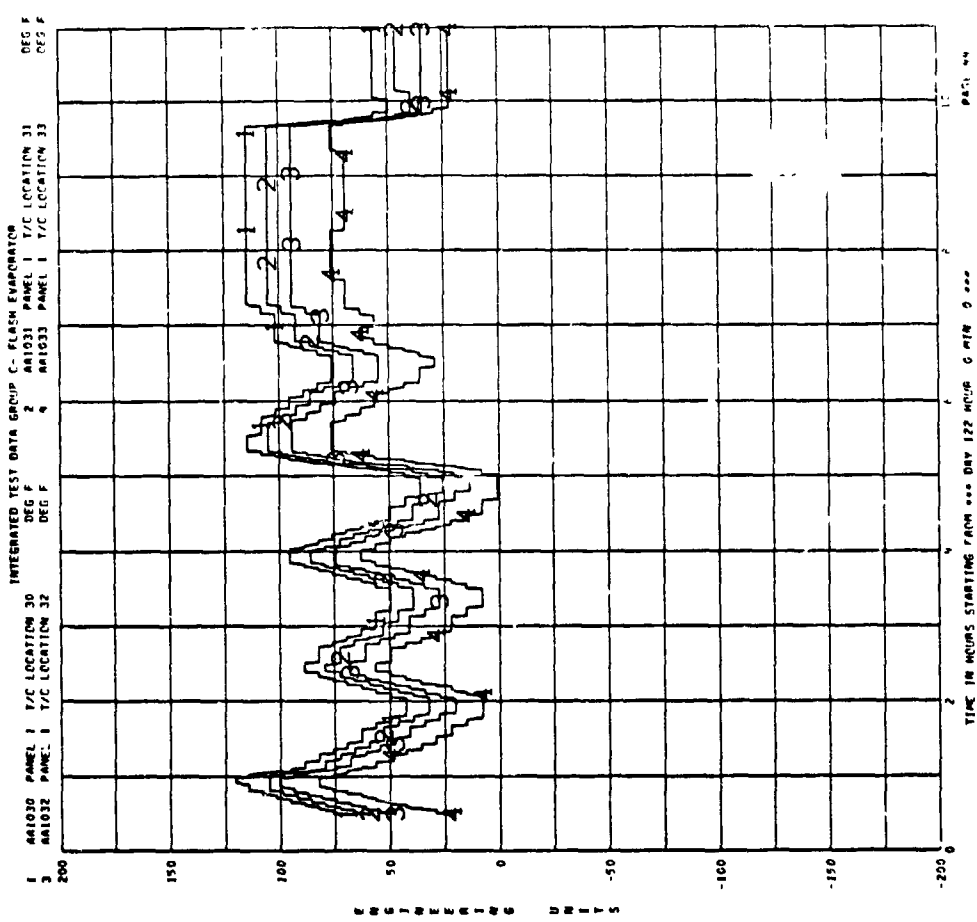
C-41

PAGE 41.

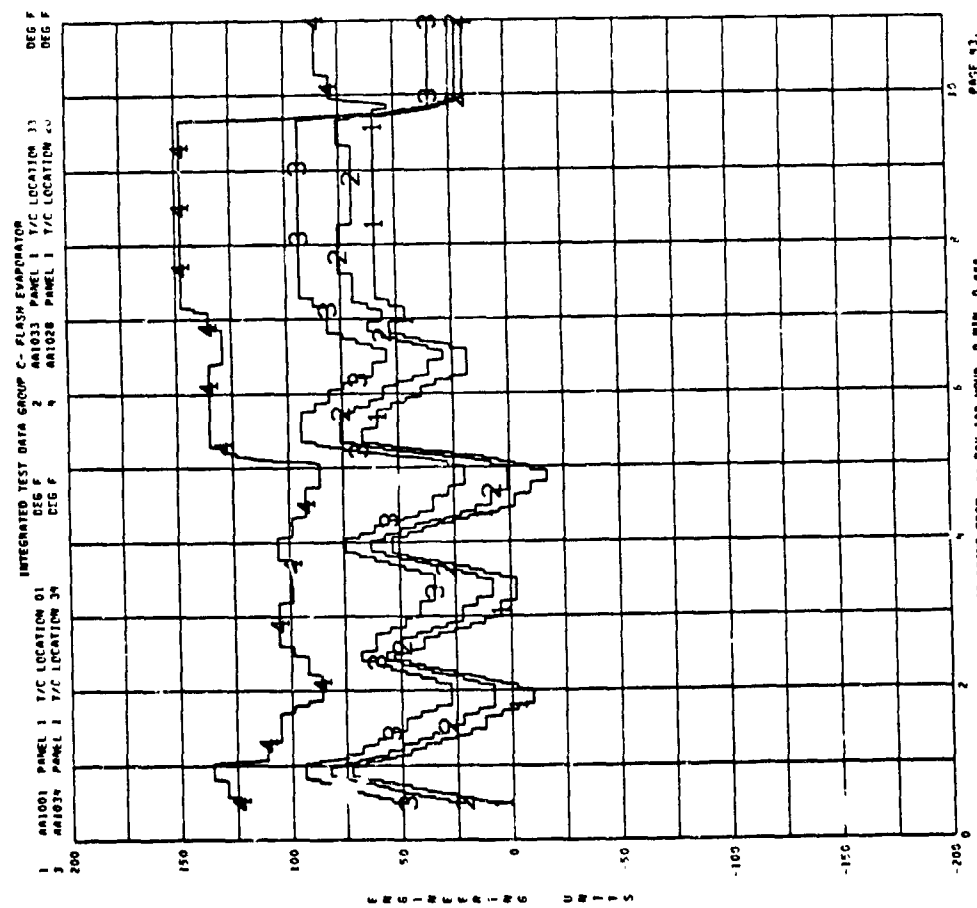


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24 July 42

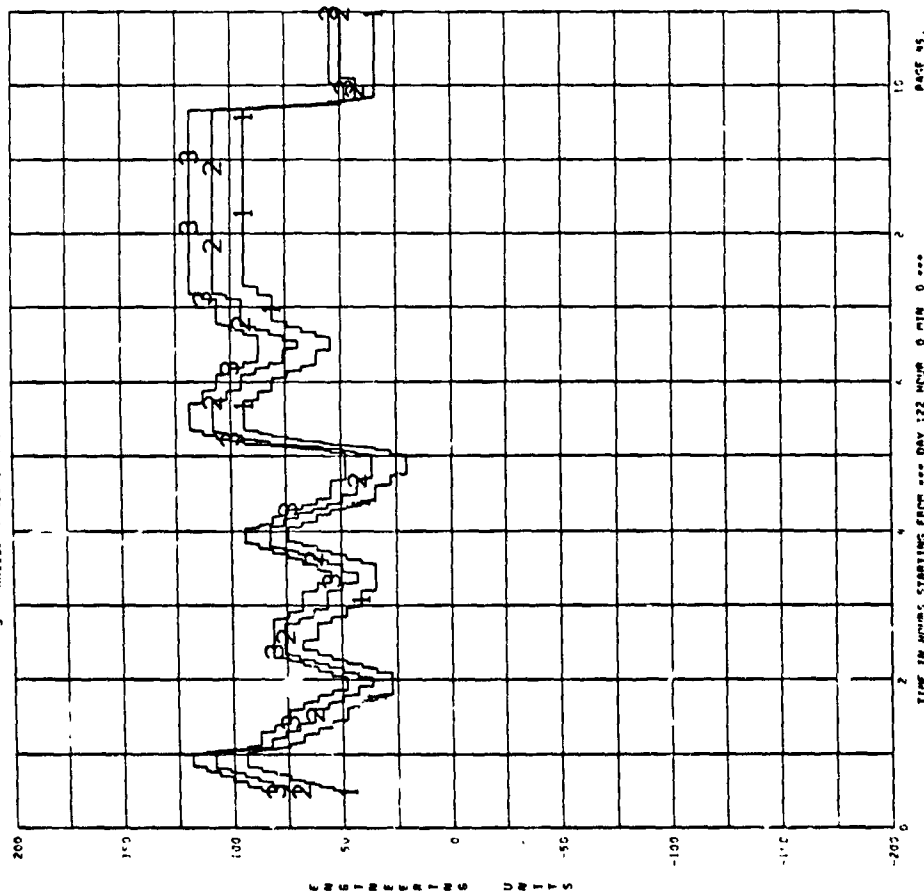


C-44



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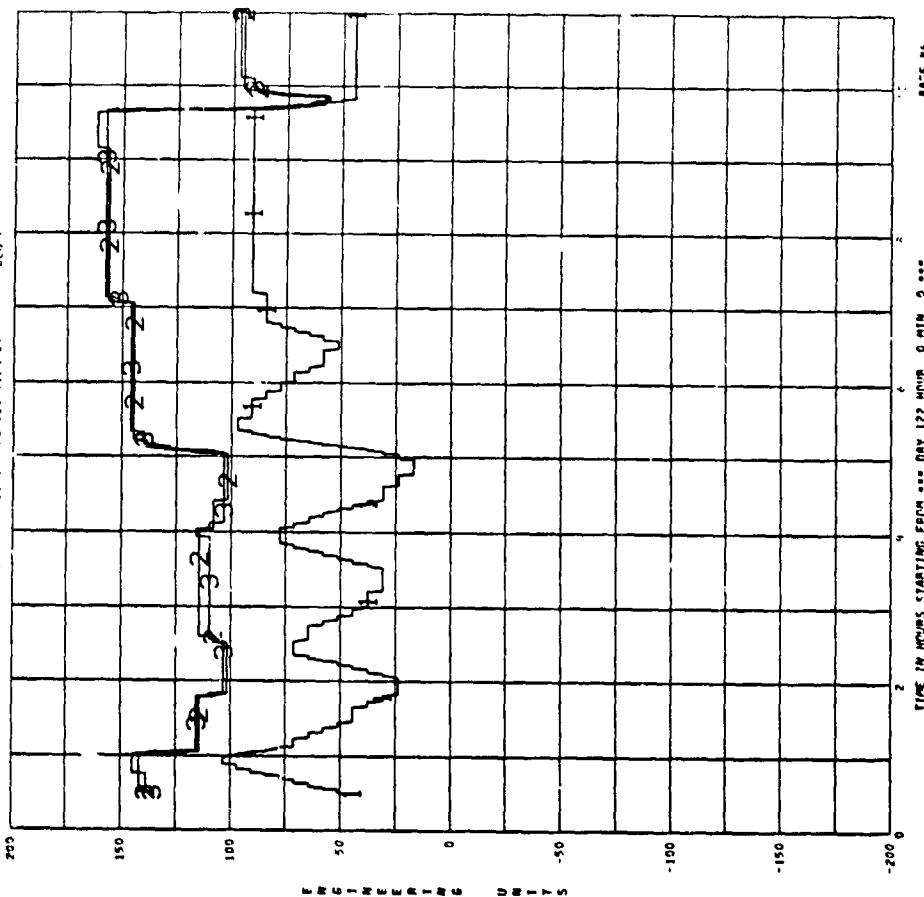
INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
 1 A1034 PANEL 1 T/C LOCATION 34 DEG F
 2 A1035 PANEL 1 T/C LOCATION 35 DEG F
 3 A1036 PANEL 1 T/C LOCATION 36 DEG F



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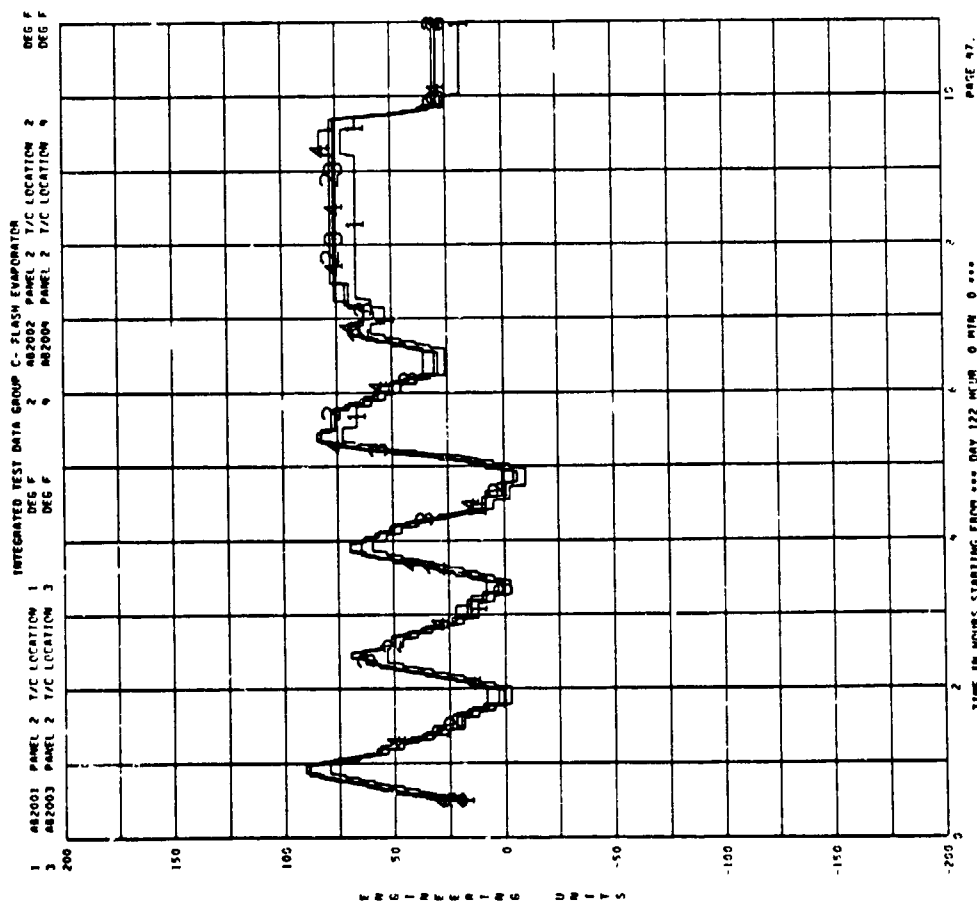
PAGE 45

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
 1 A1011 PANEL 1 T/C LOCATION 11 DEG F
 2 A1012 PANEL 1 T/C LOCATION 12 DEG F
 3 A1029 PANEL 1 T/C LOCATION 29 DEG F

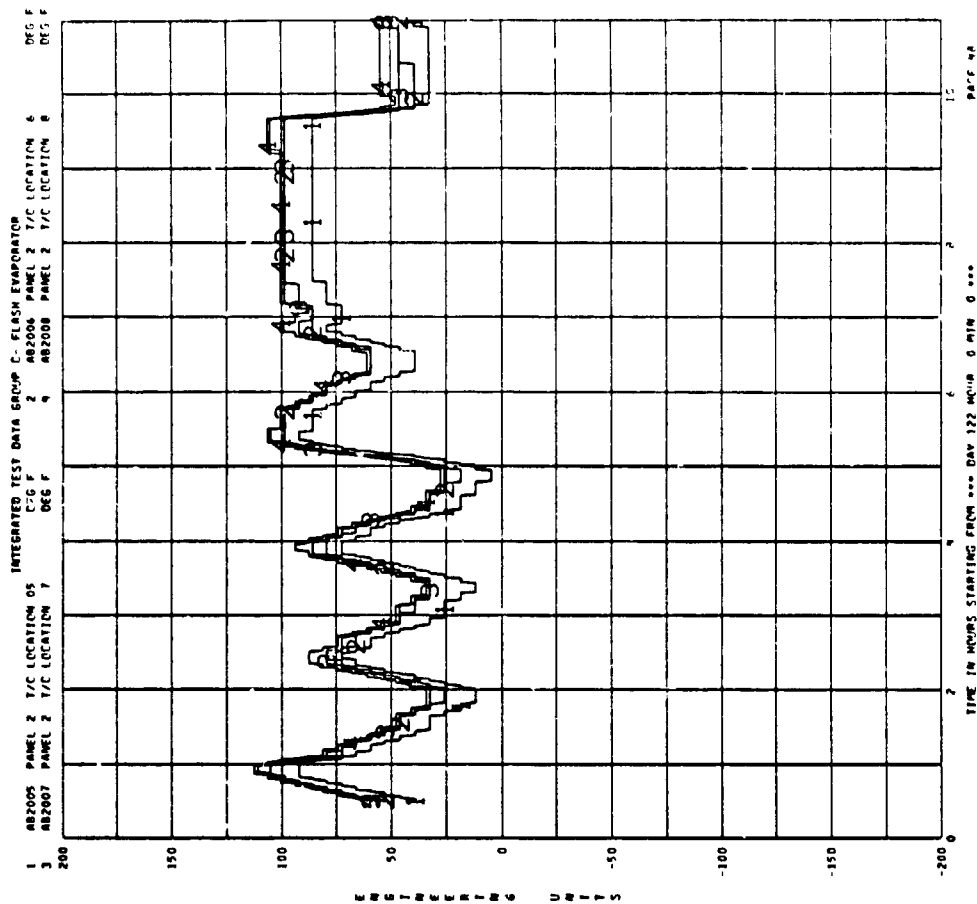


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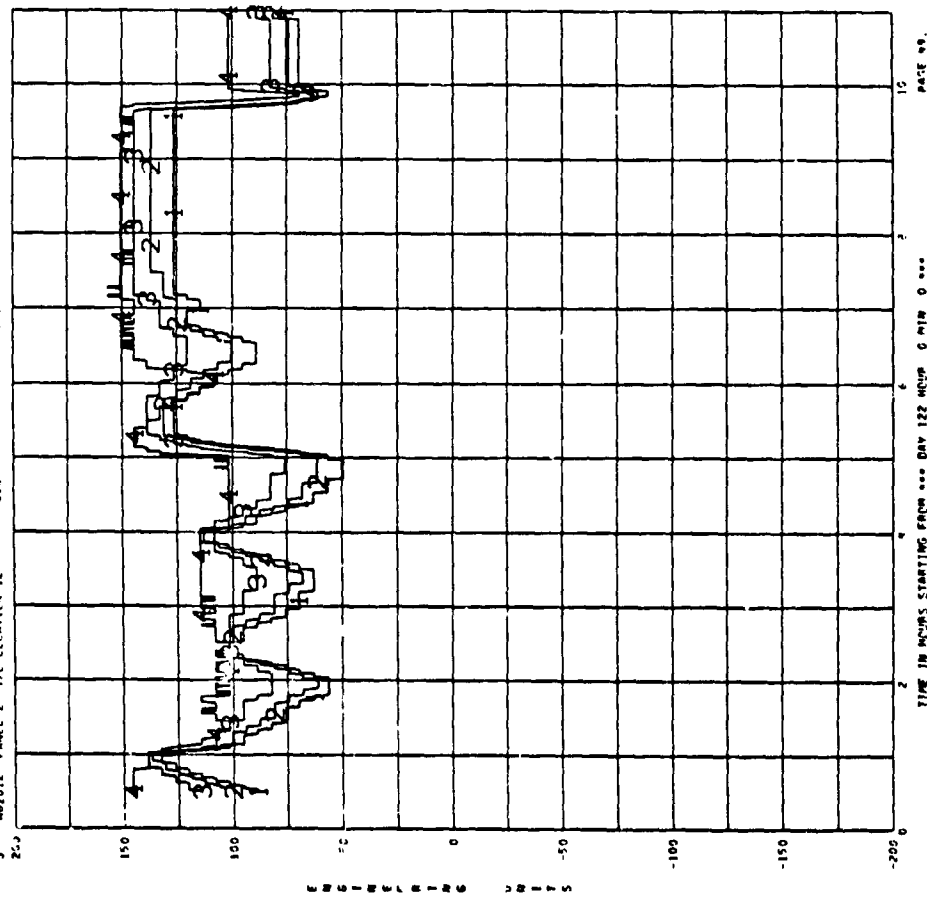
C-47



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INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

1 AB2009 PANEL 2 T/C LOCATION 09 DEG F
 2 AB2010 PANEL 2 T/C LOCATION 10 DEG F
 3 AB2012 PANEL 2 T/C LOCATION 12 DEG F
 4 AB2013 PANEL 2 T/C LOCATION 13 DEG F

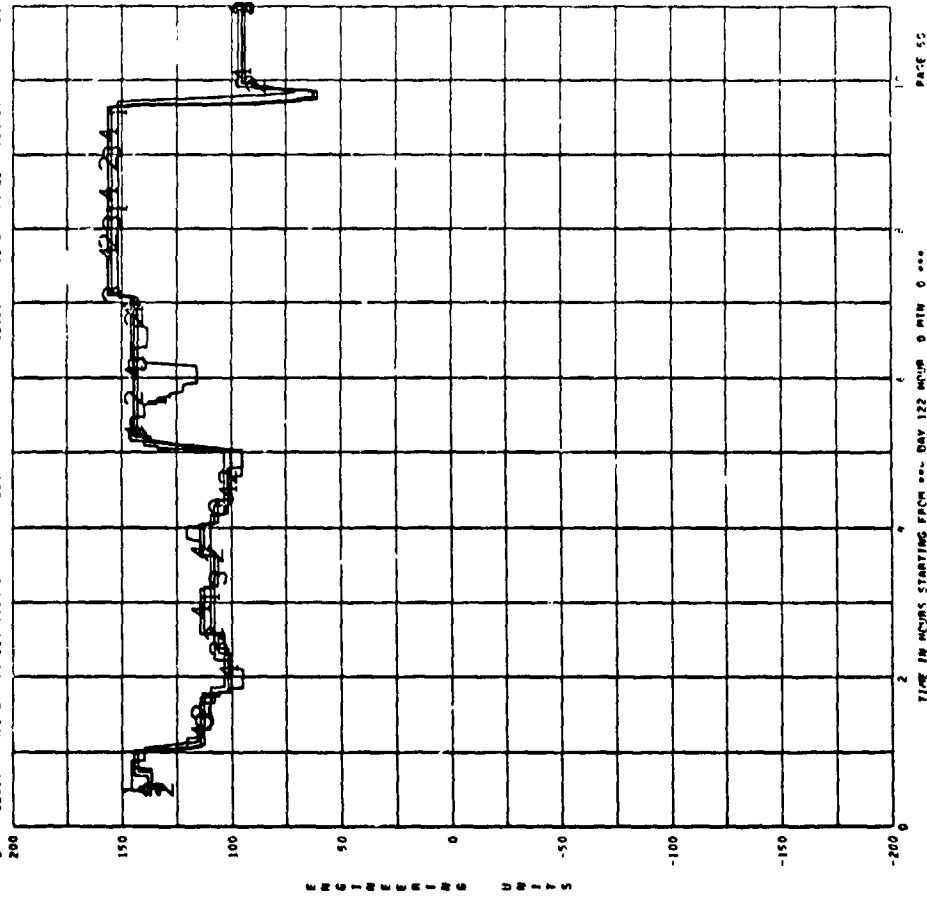


TIME IN HOURS STARTING FROM 000 DAY 122 HOUR 0 MIN 0 SEC PAGE 49

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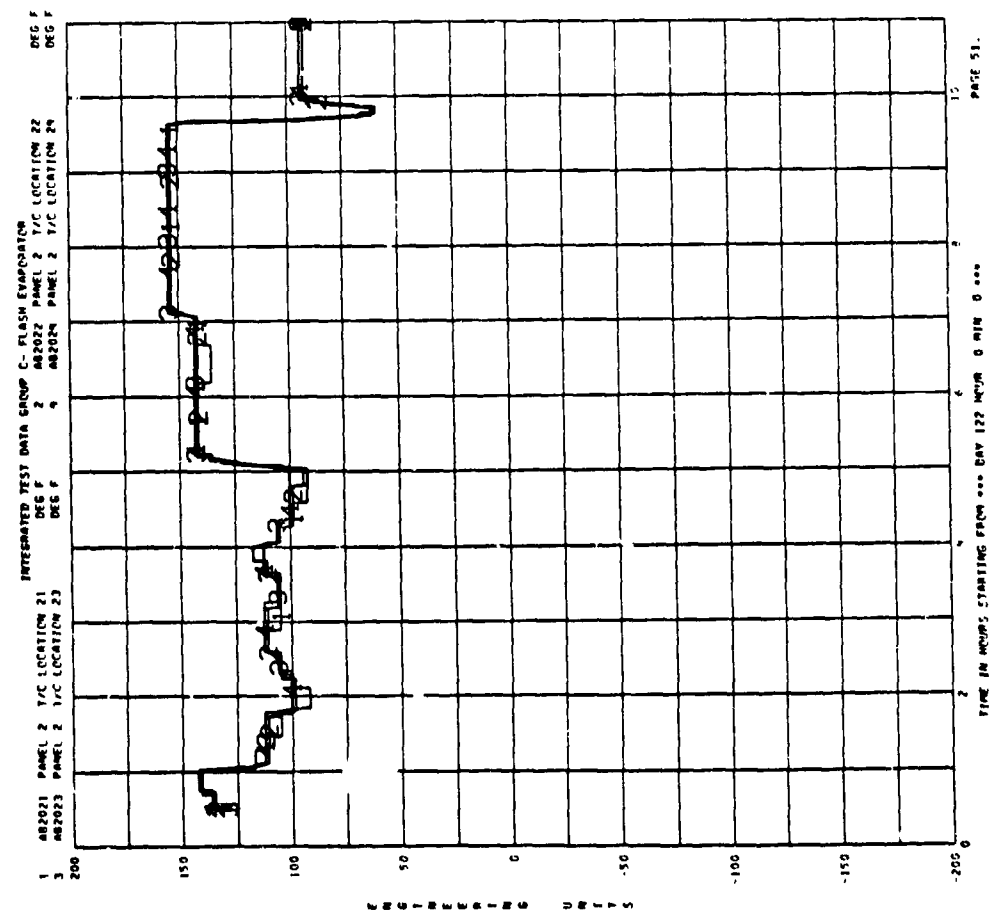
INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

1 AB2014 PANEL 2 T/C LOCATION 14 DEG F
 2 AB2017 PANEL 2 T/C LOCATION 17 DEG F
 3 AB2019 PANEL 2 T/C LOCATION 19 DEG F
 4 AB2020 PANEL 2 T/C LOCATION 20 DEG F

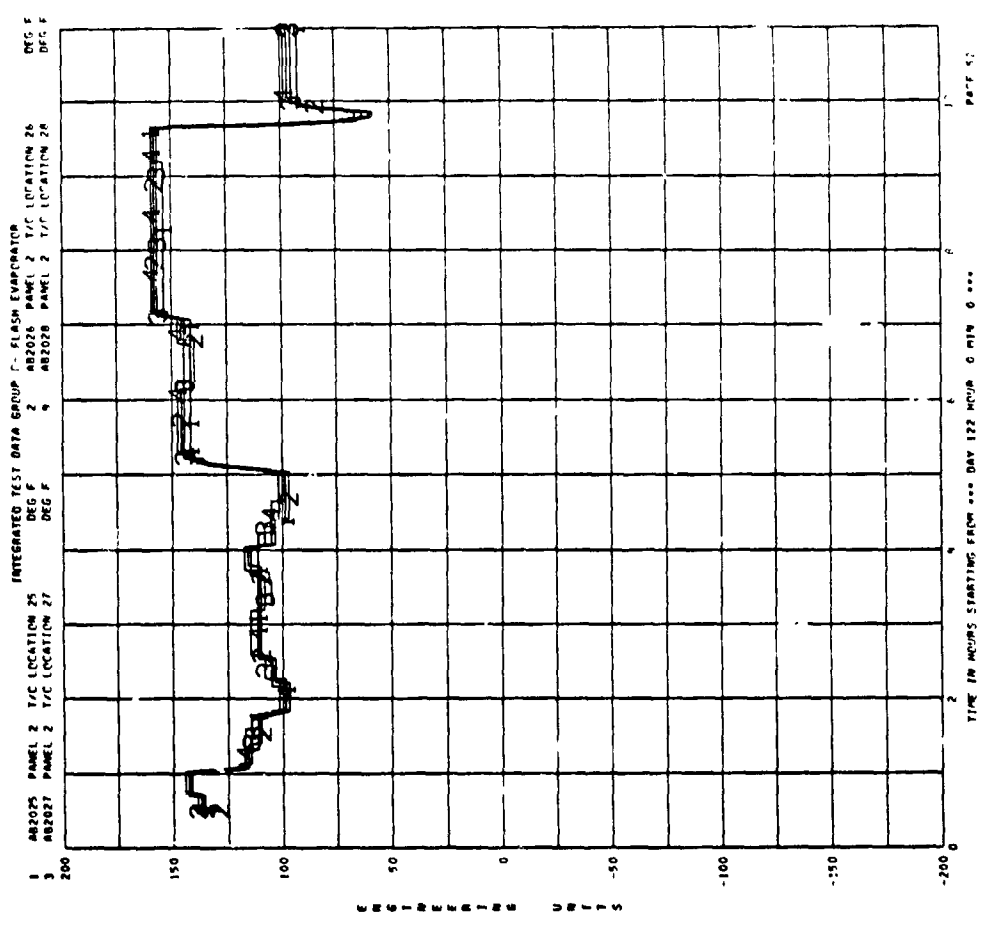


TIME IN HOURS STARTING FROM 000 DAY 122 HOUR 0 MIN 0 SEC PAGE 50

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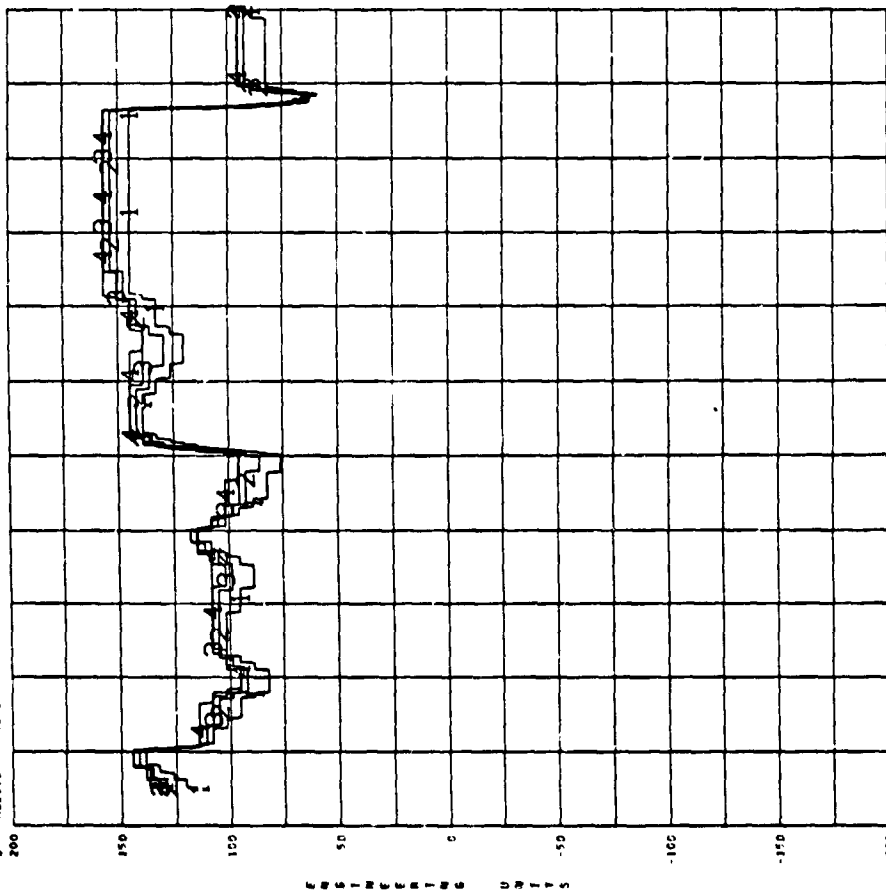


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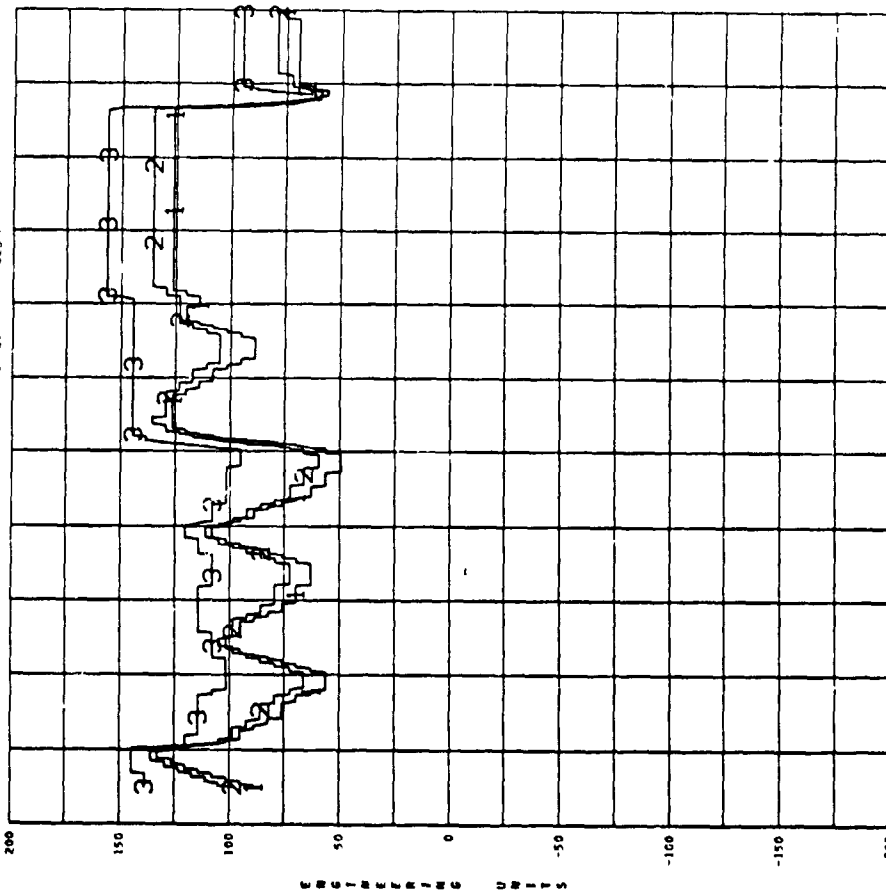
1 AB2012 PANEL 2 T/C LOCATION 12 DEG F 2 AB2015 PANEL 2 T/C LOCATION 15 DEG F
 3 AB2016 PANEL 2 T/C LOCATION 16 DEG F 4 AB2017 PANEL 2 T/C LOCATION 17 DEG F



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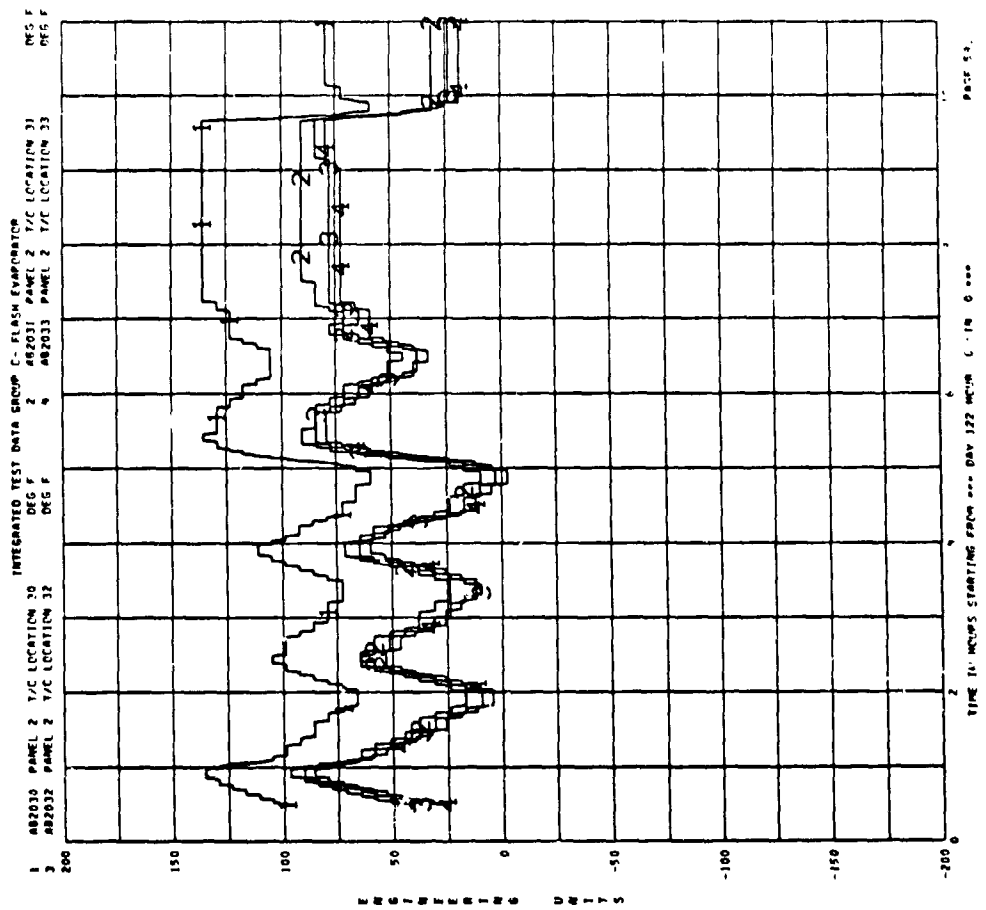
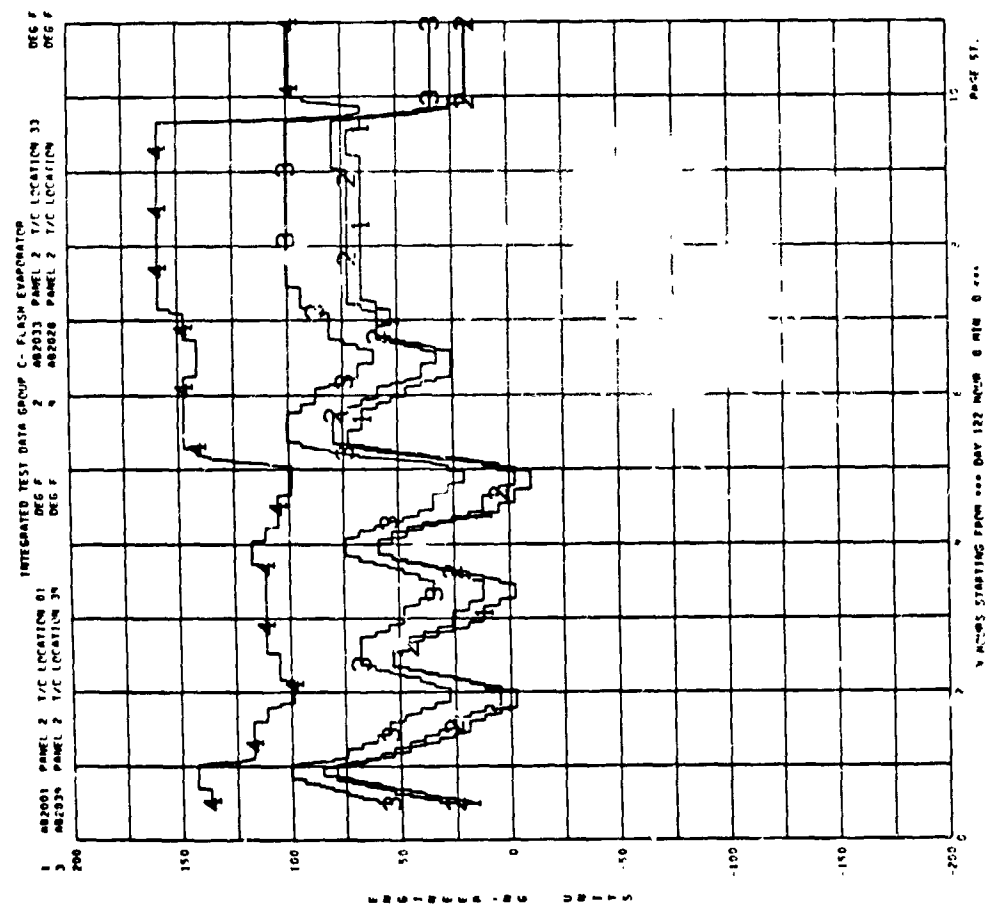
C-53

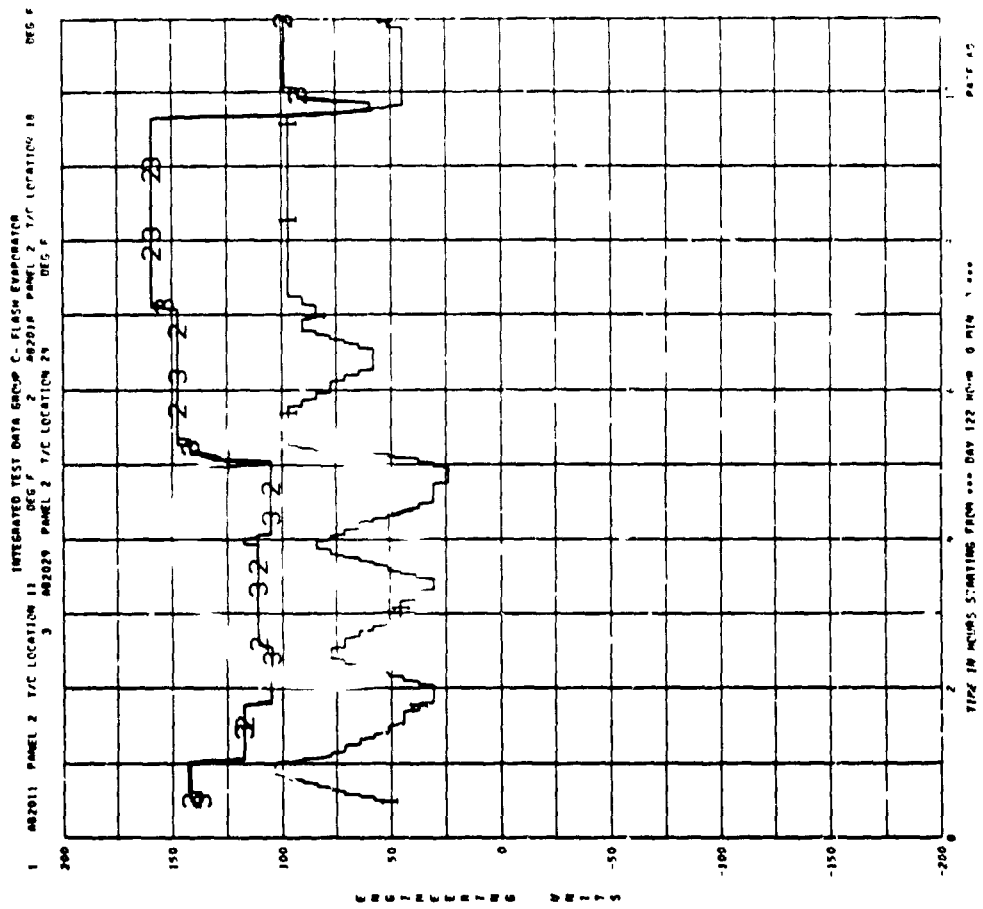
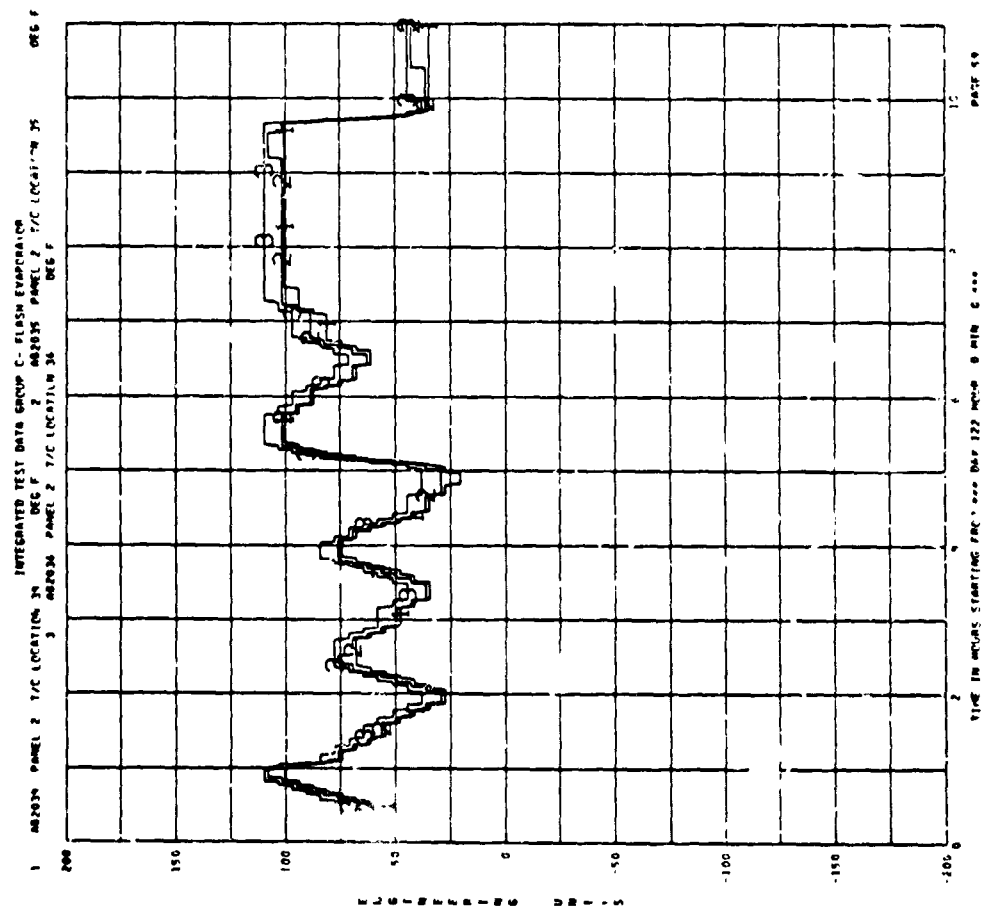
1 AB2009 PANEL 2 T/C LOCATION 09 DEG F 2 AB2010 PANEL 2 T/C LOCATION 10 DEG F
 3 AB2020 PANEL 2 T/C LOCATION 20 DEG F

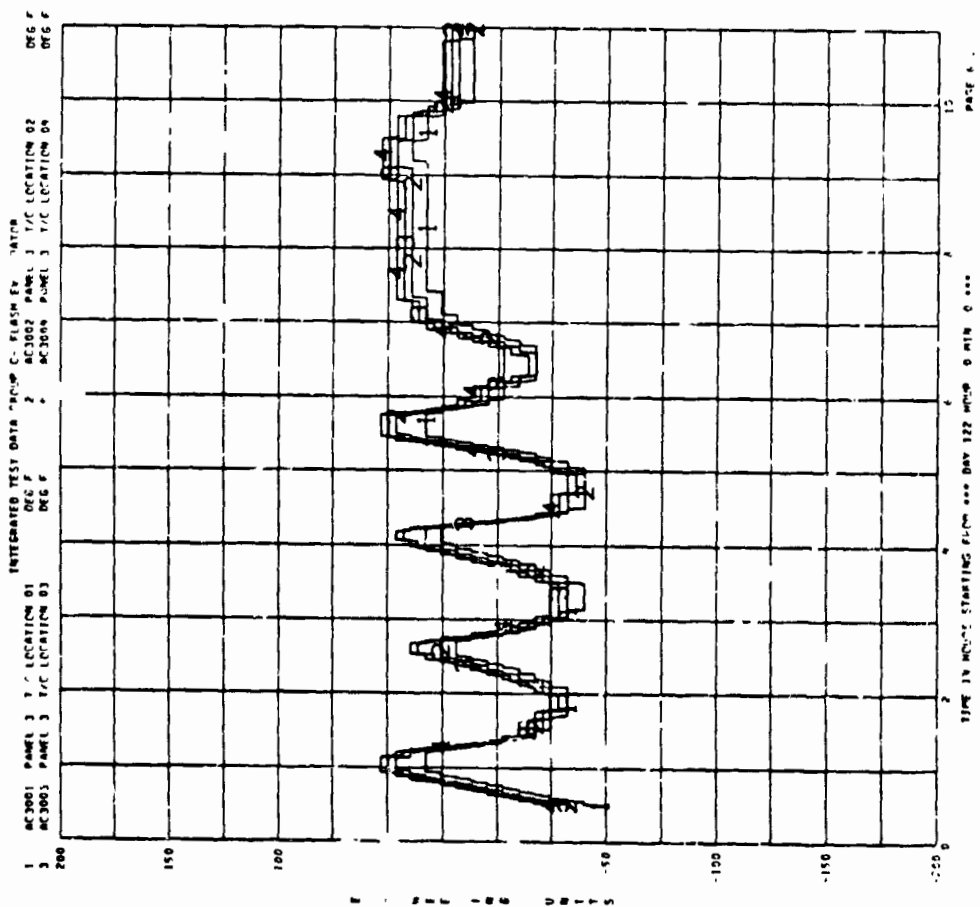


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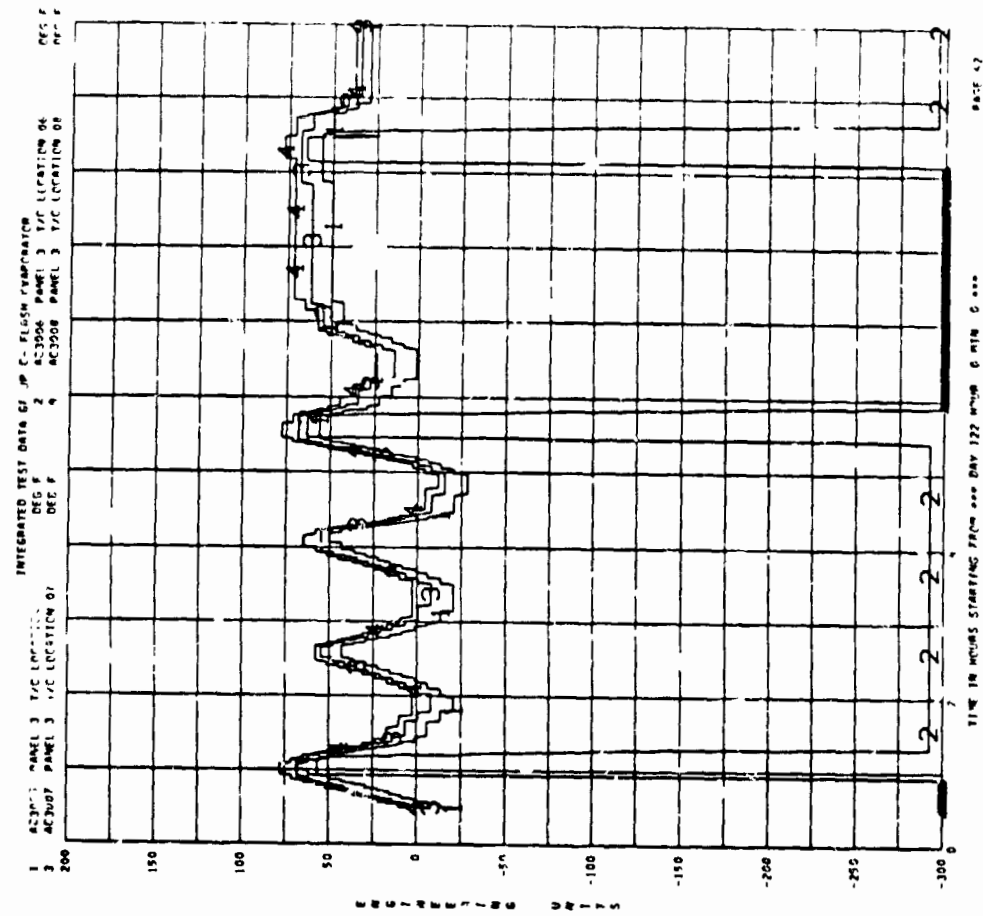
C-54





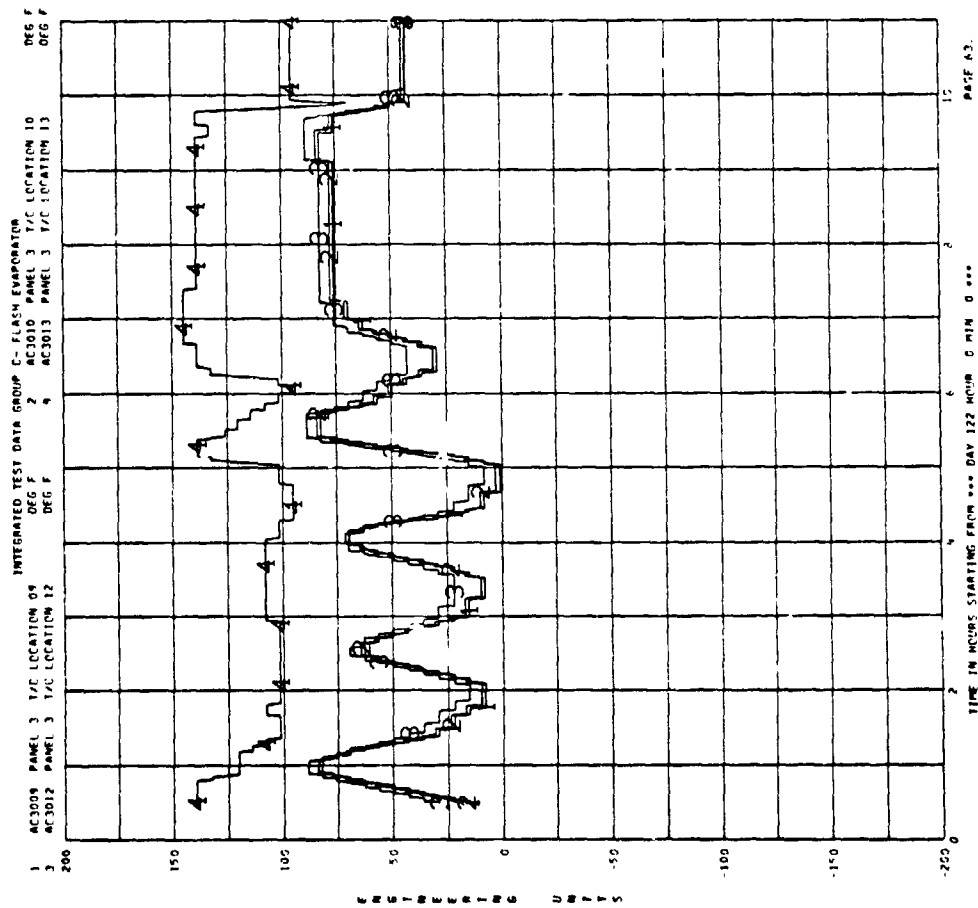


C-61

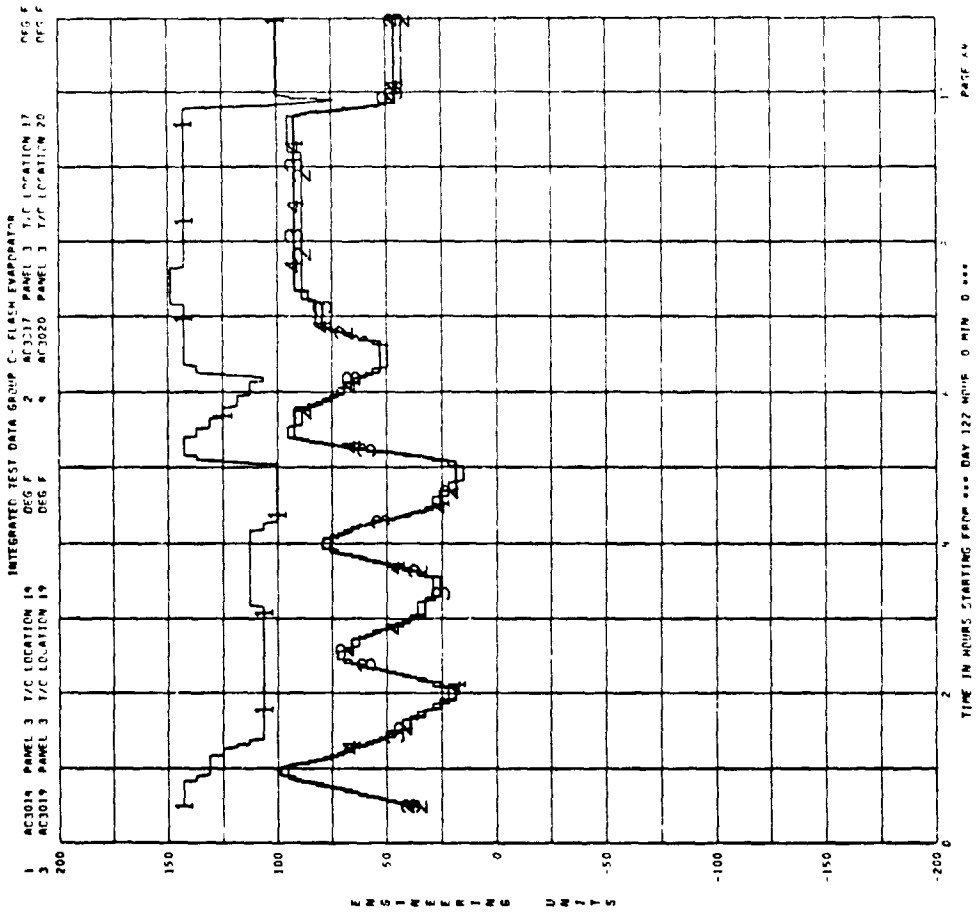


C-62

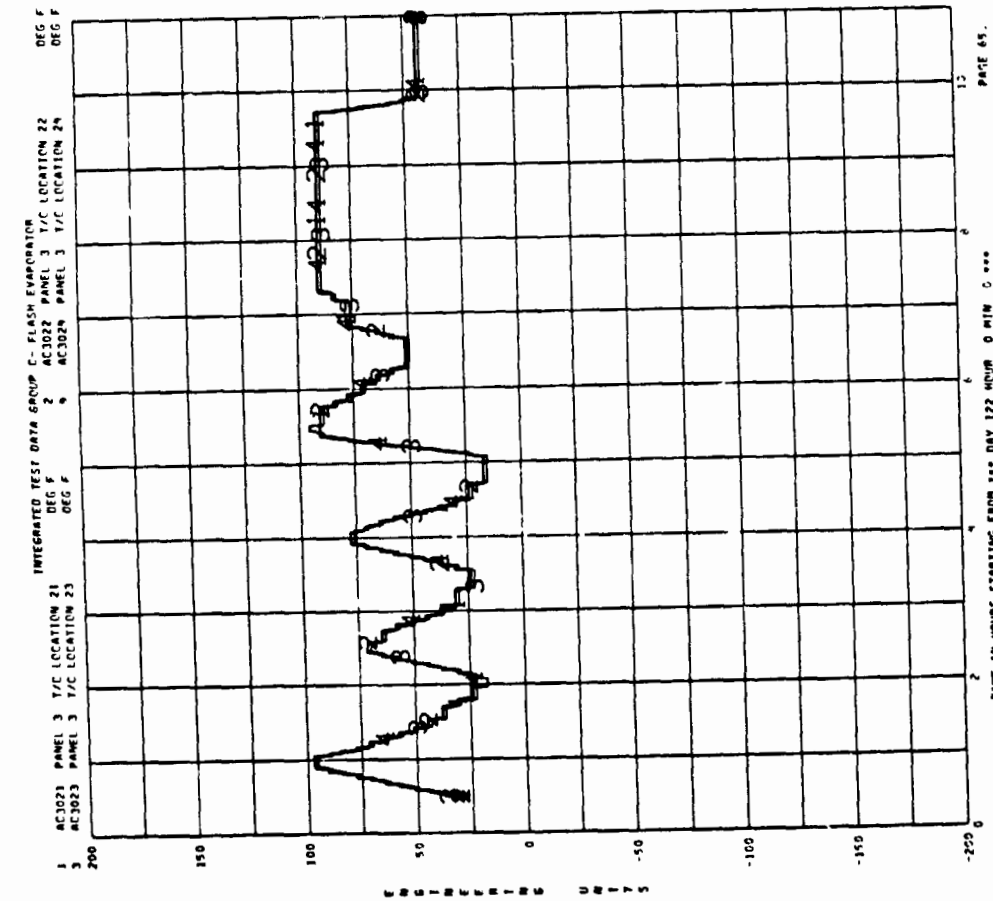
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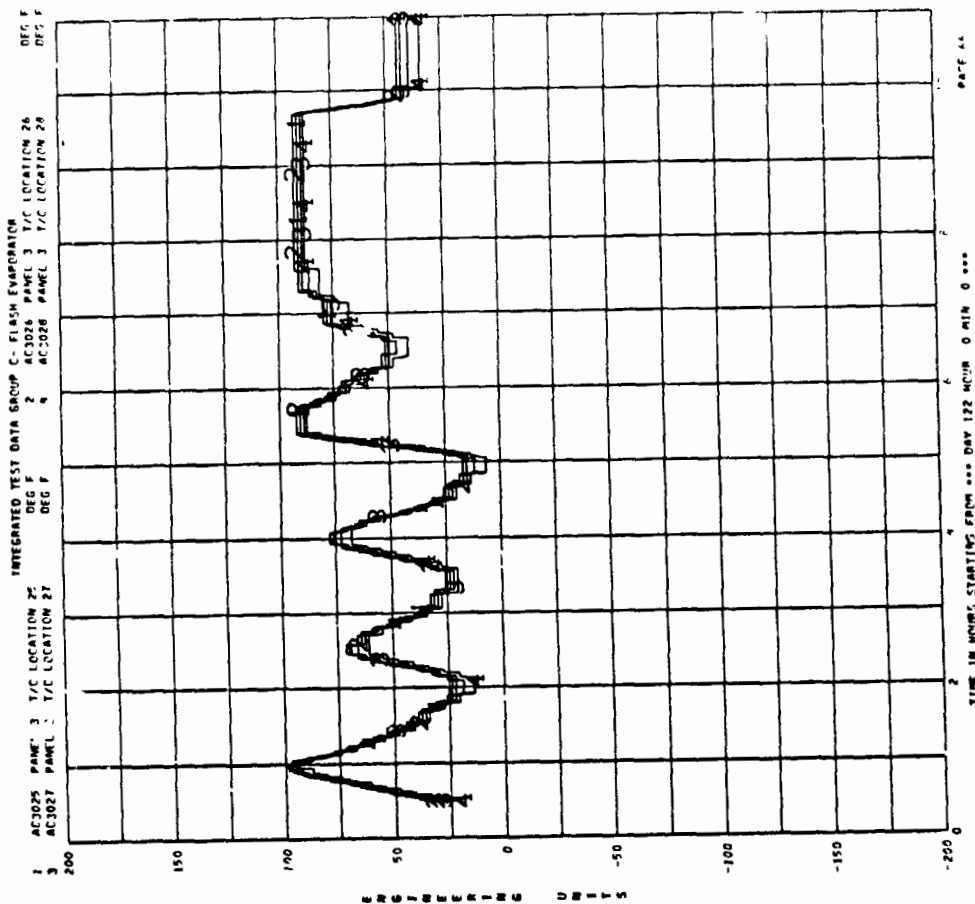
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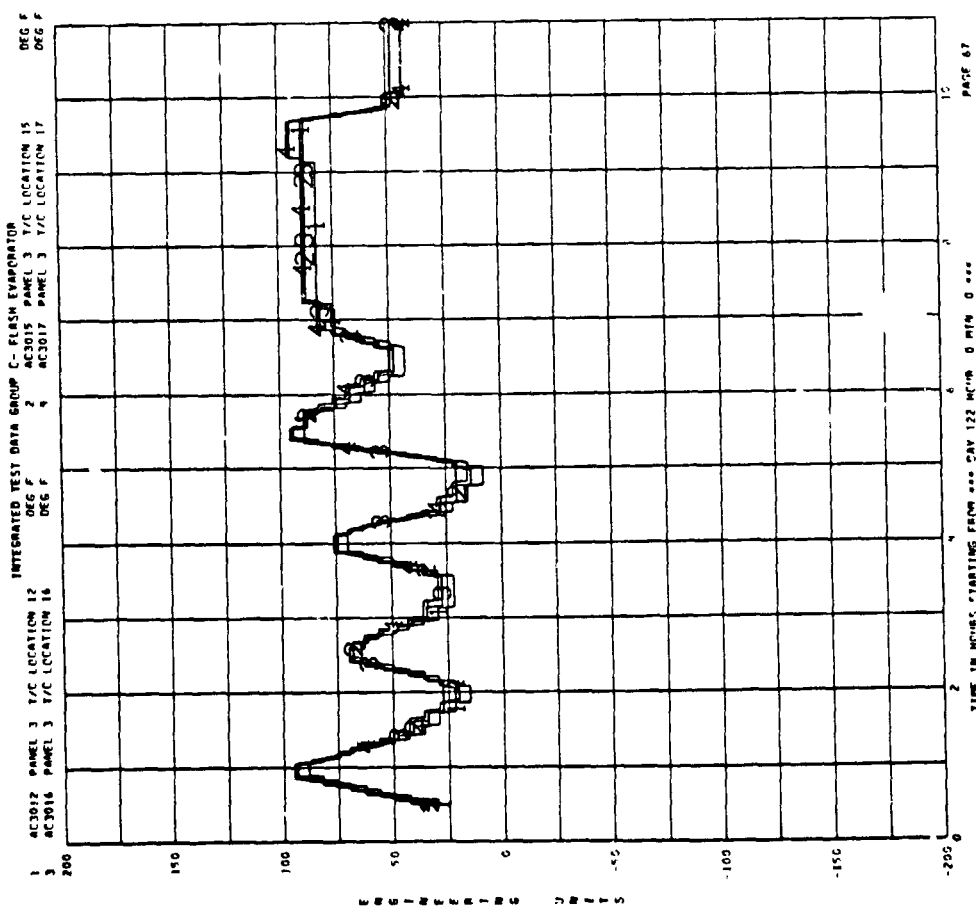
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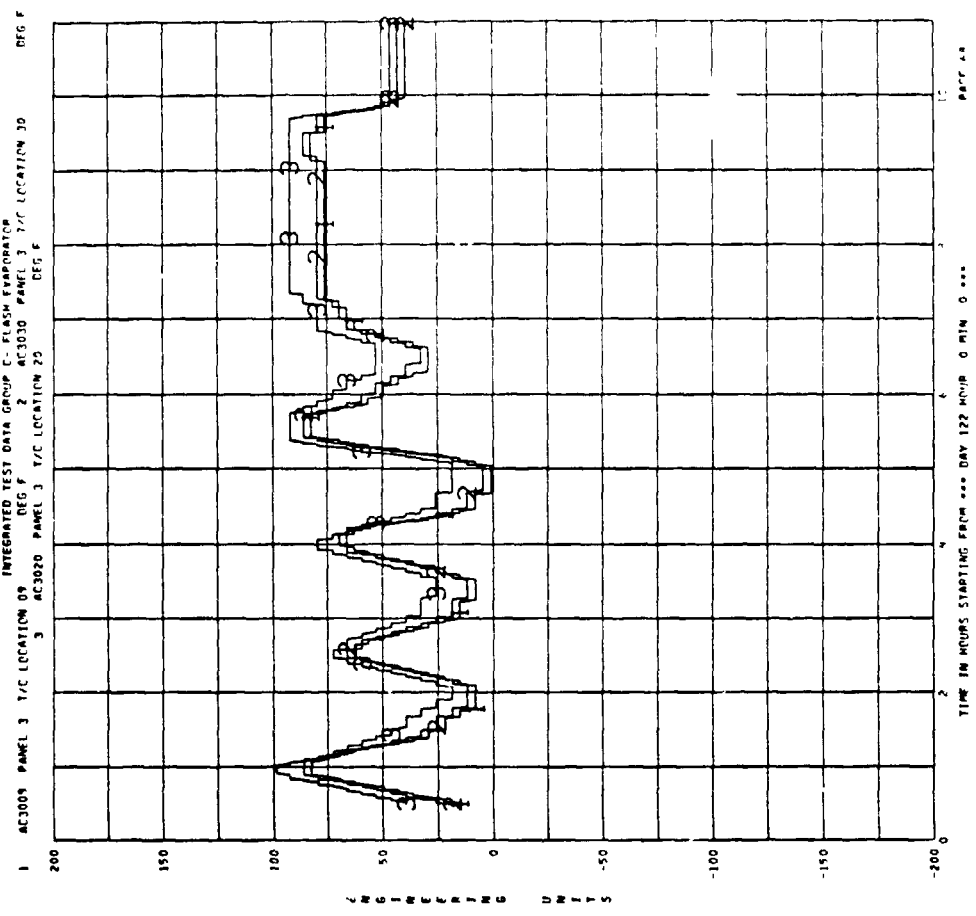
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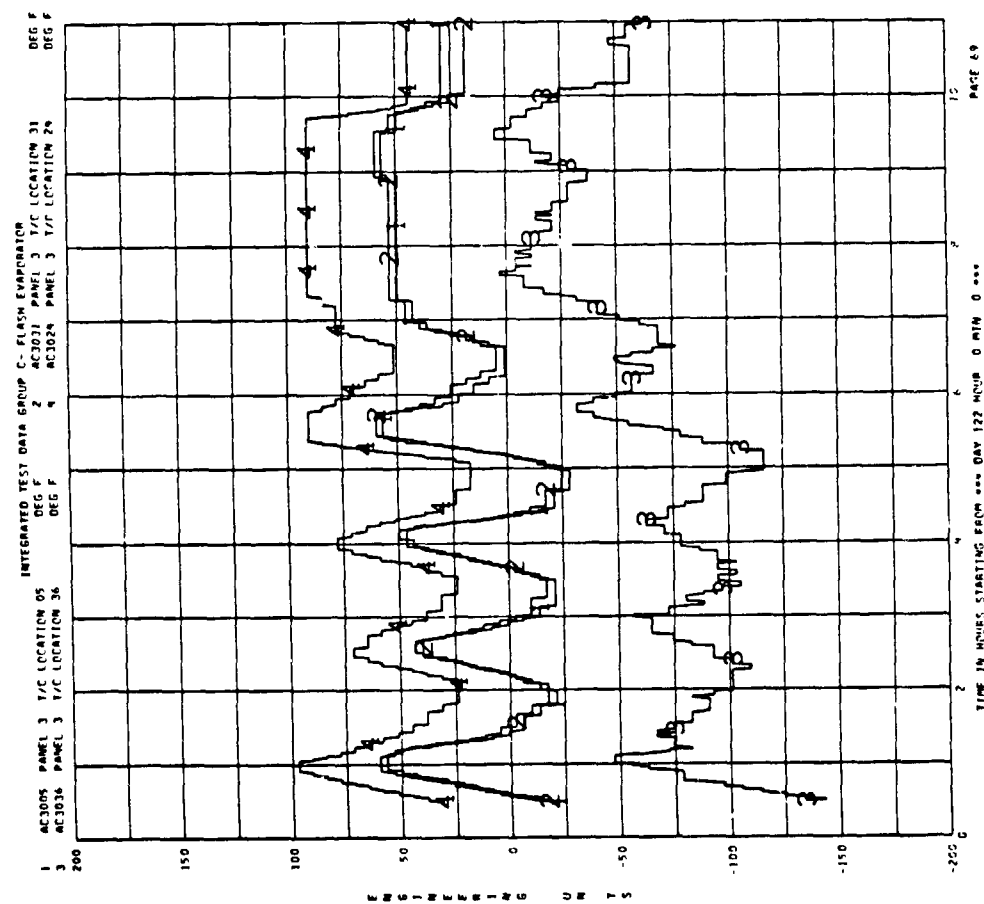
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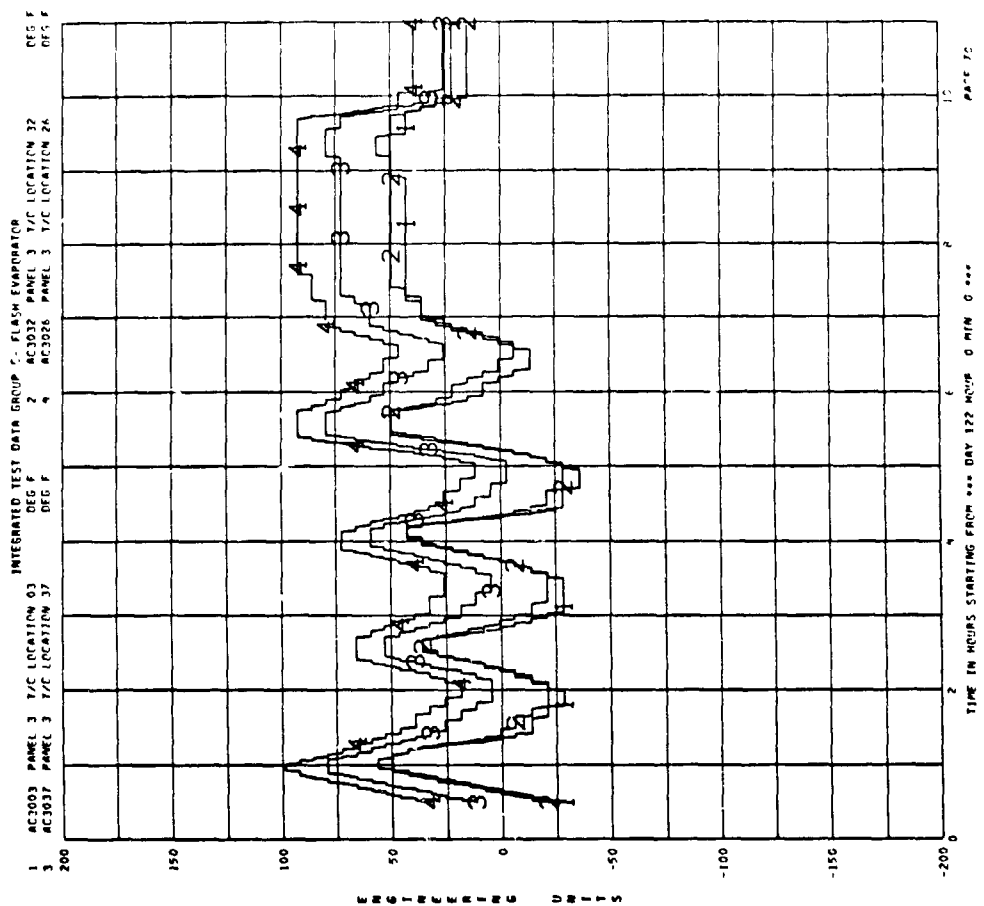
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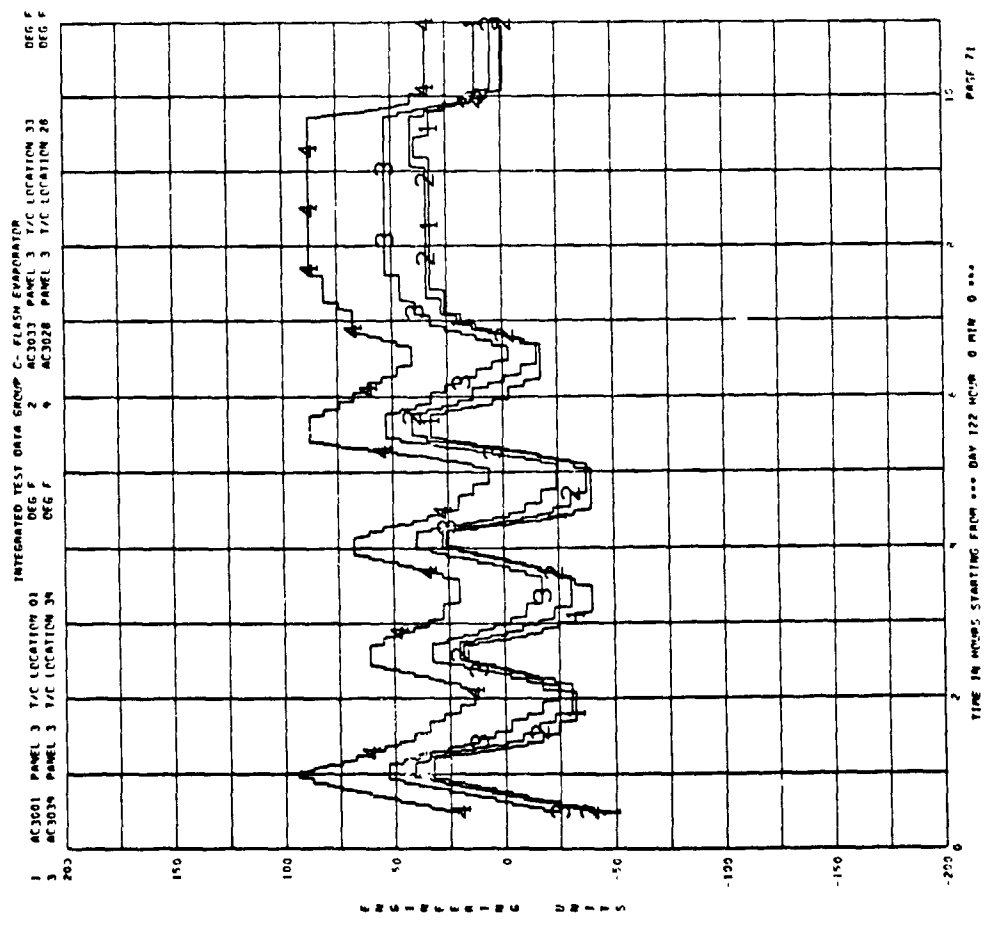
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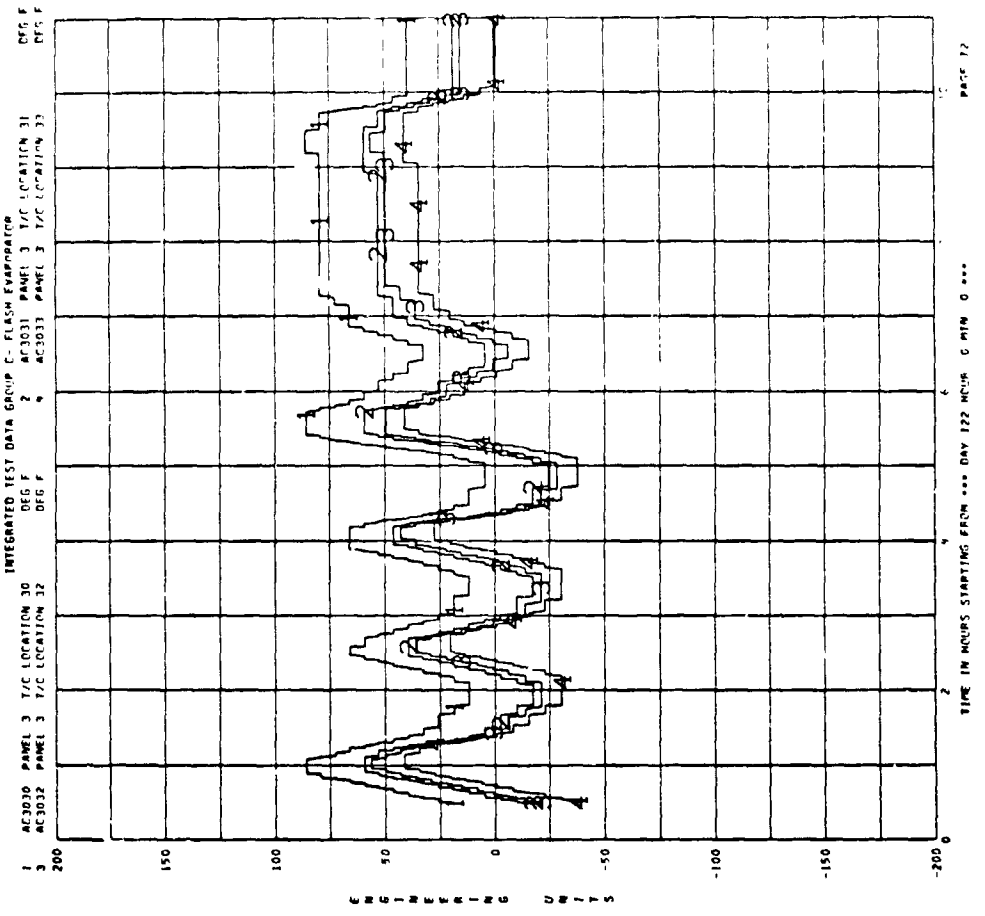
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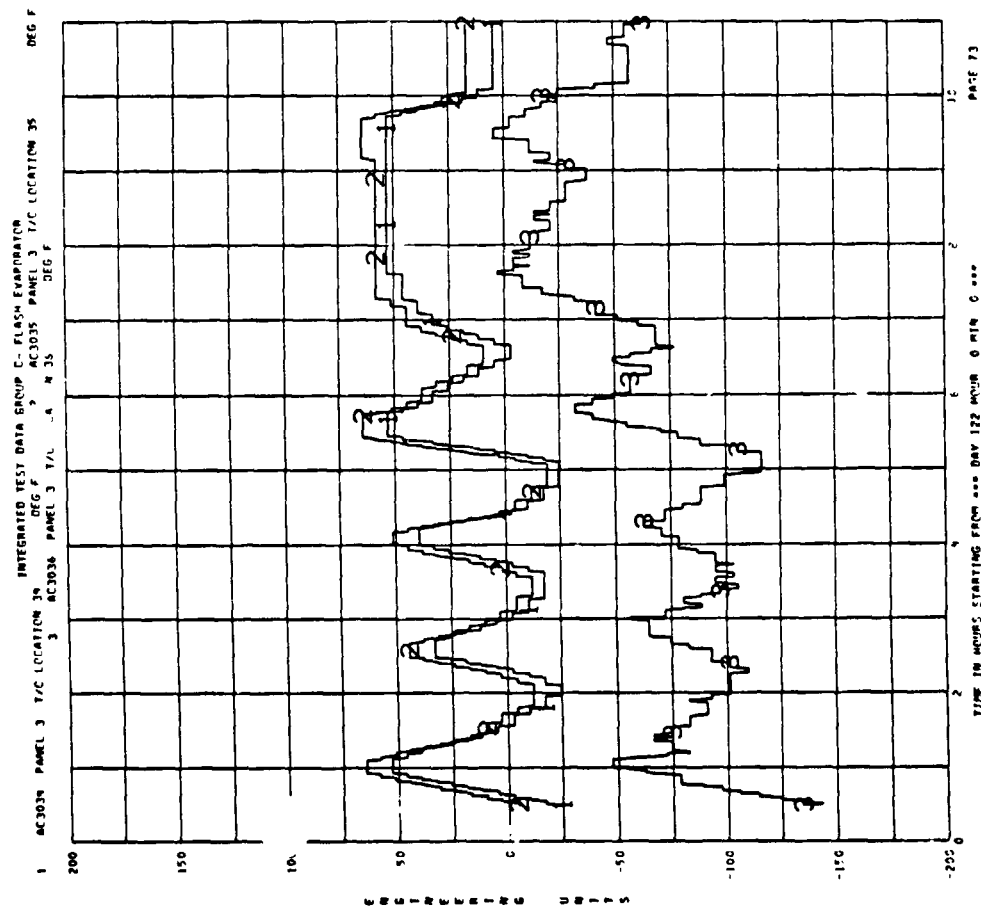
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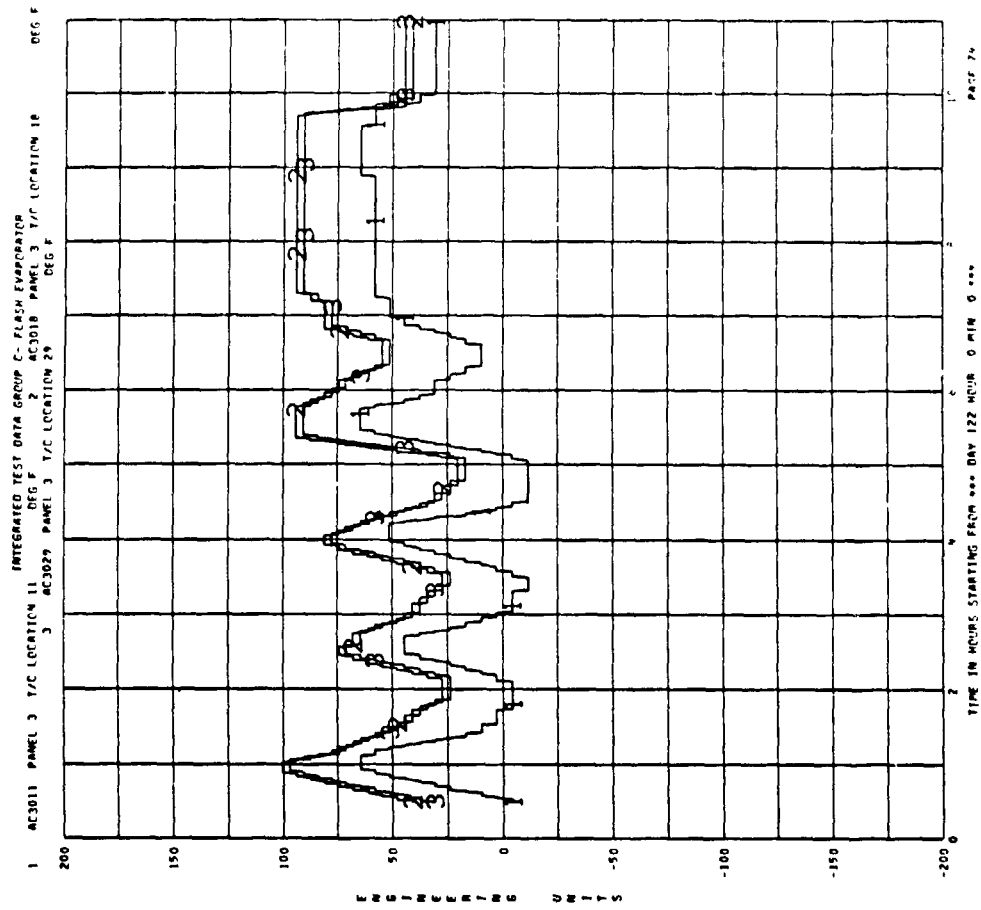
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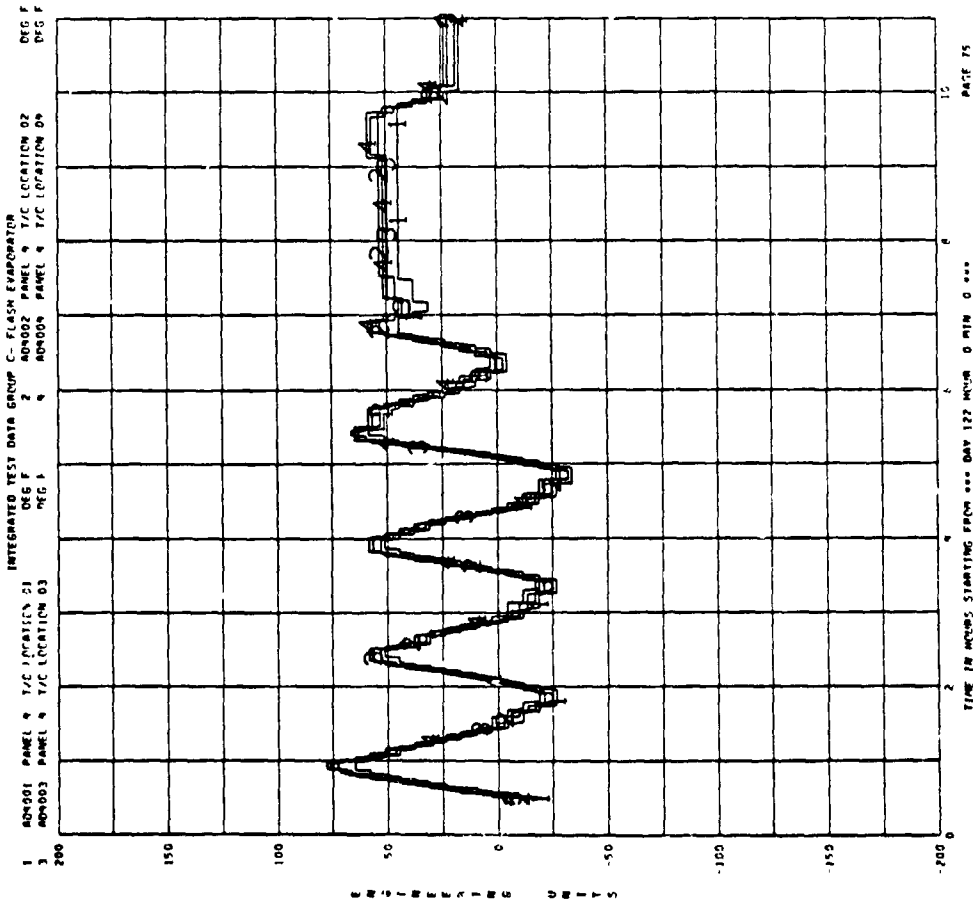
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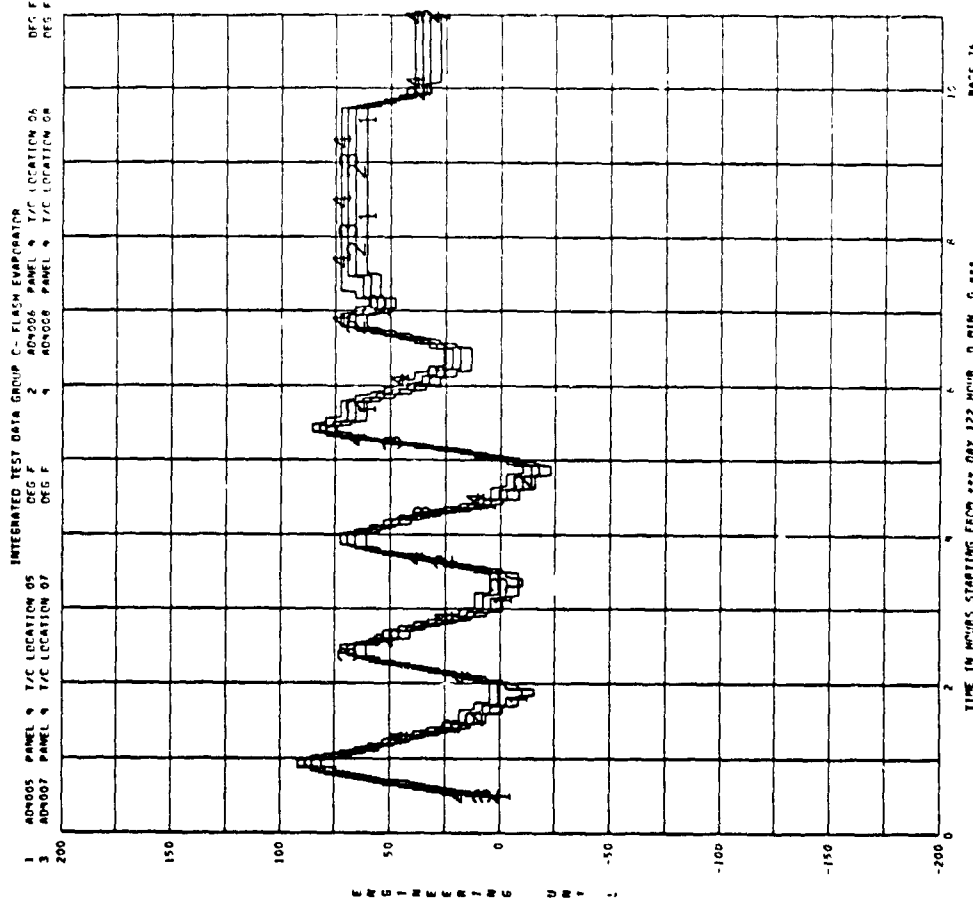
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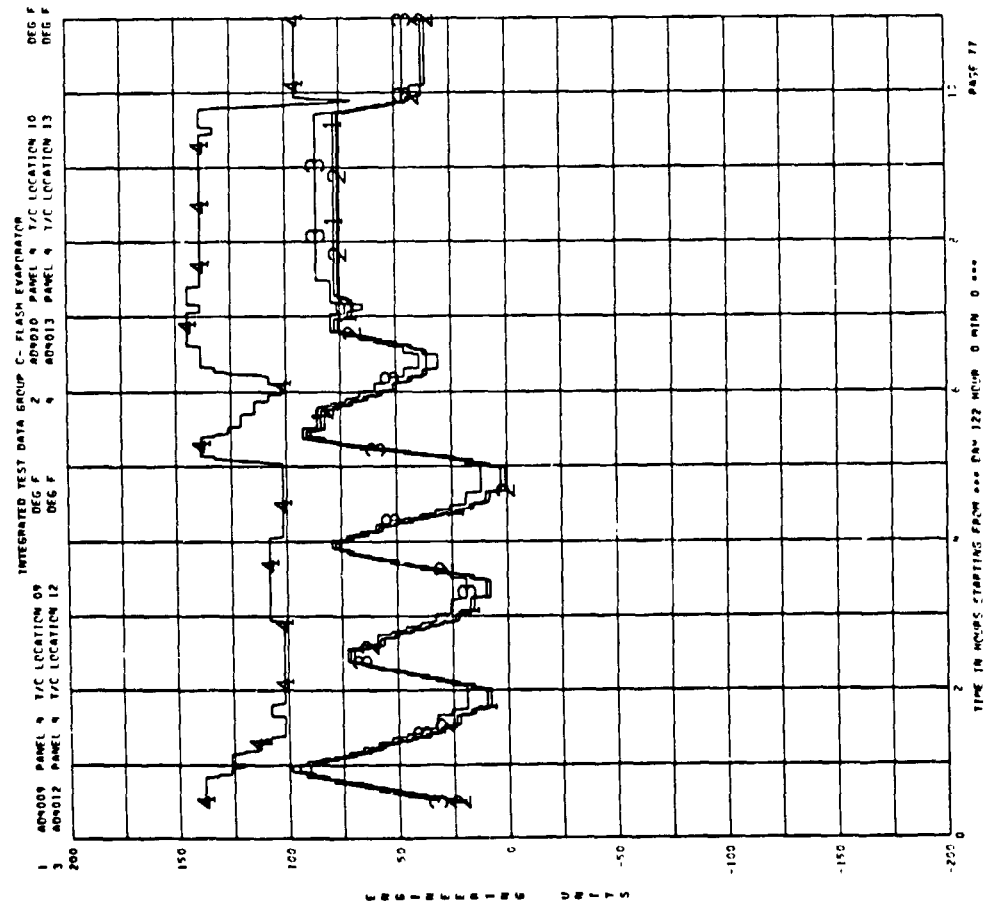
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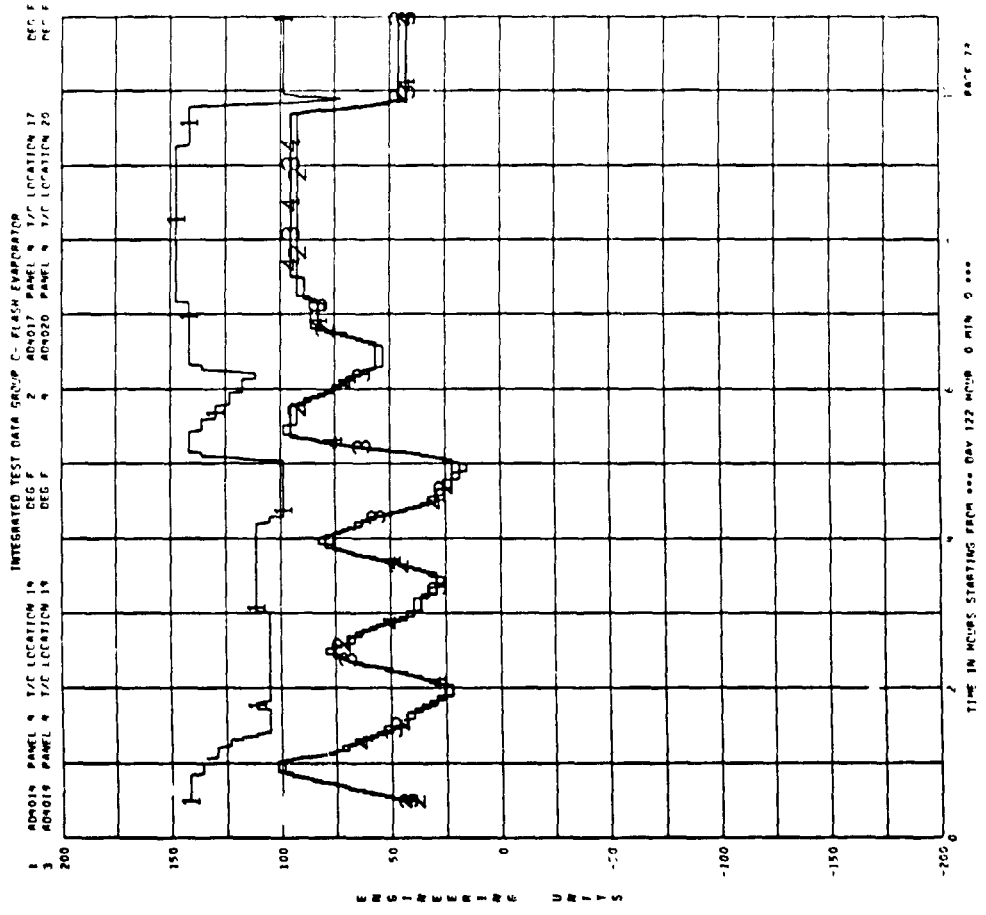
C-75



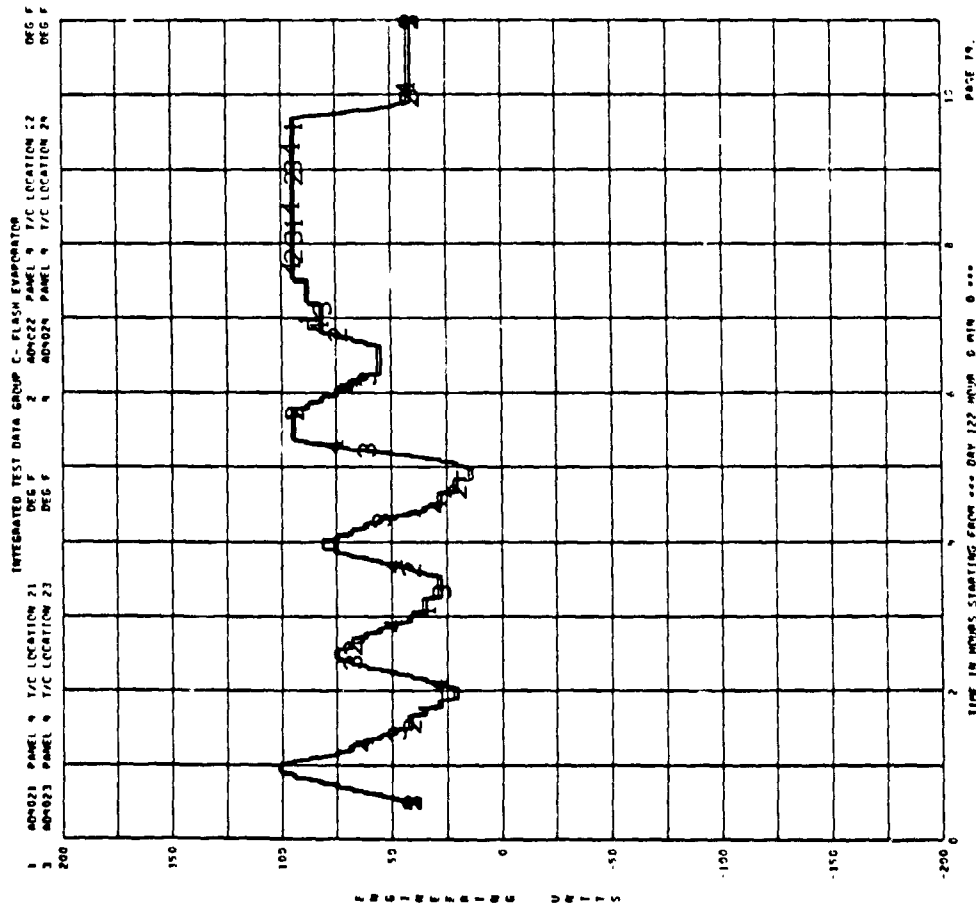
C-76



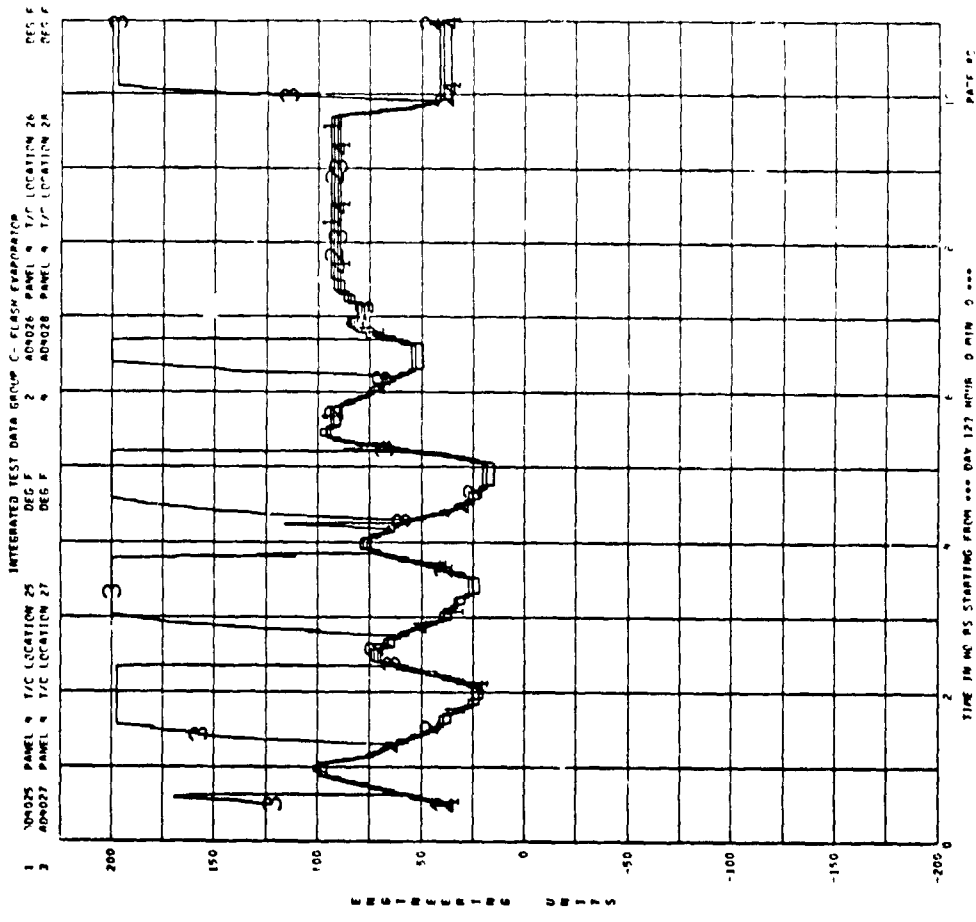
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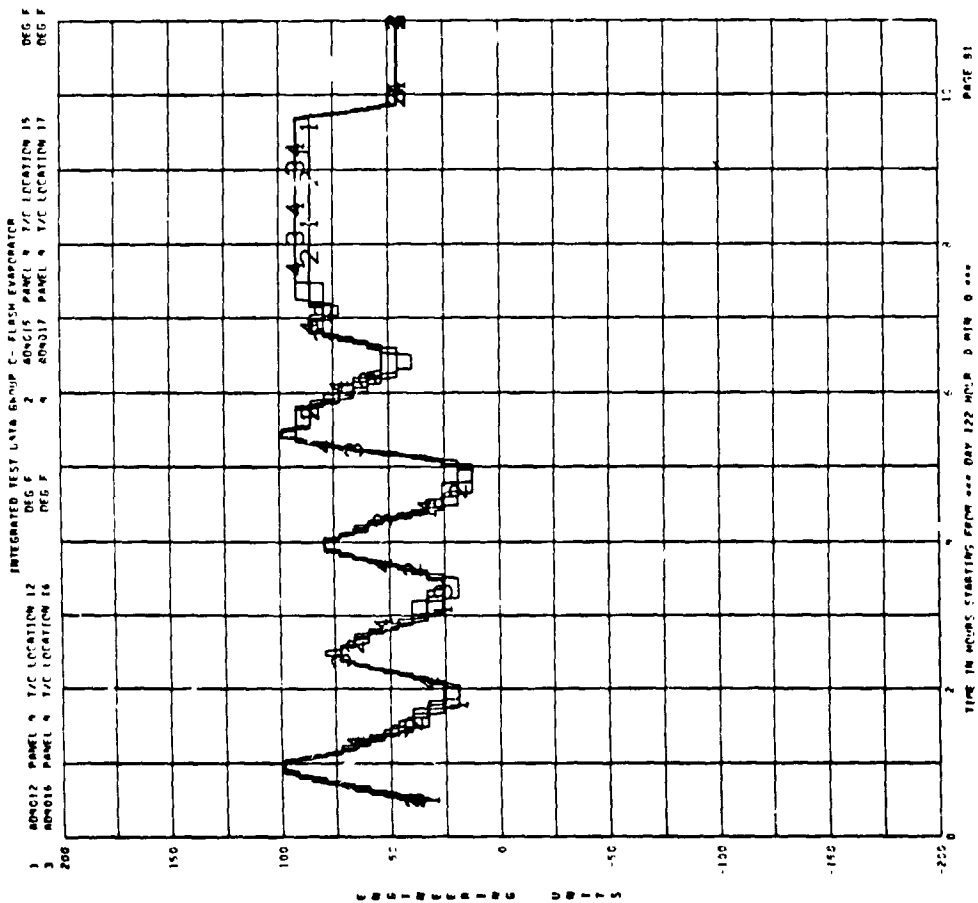
C-78



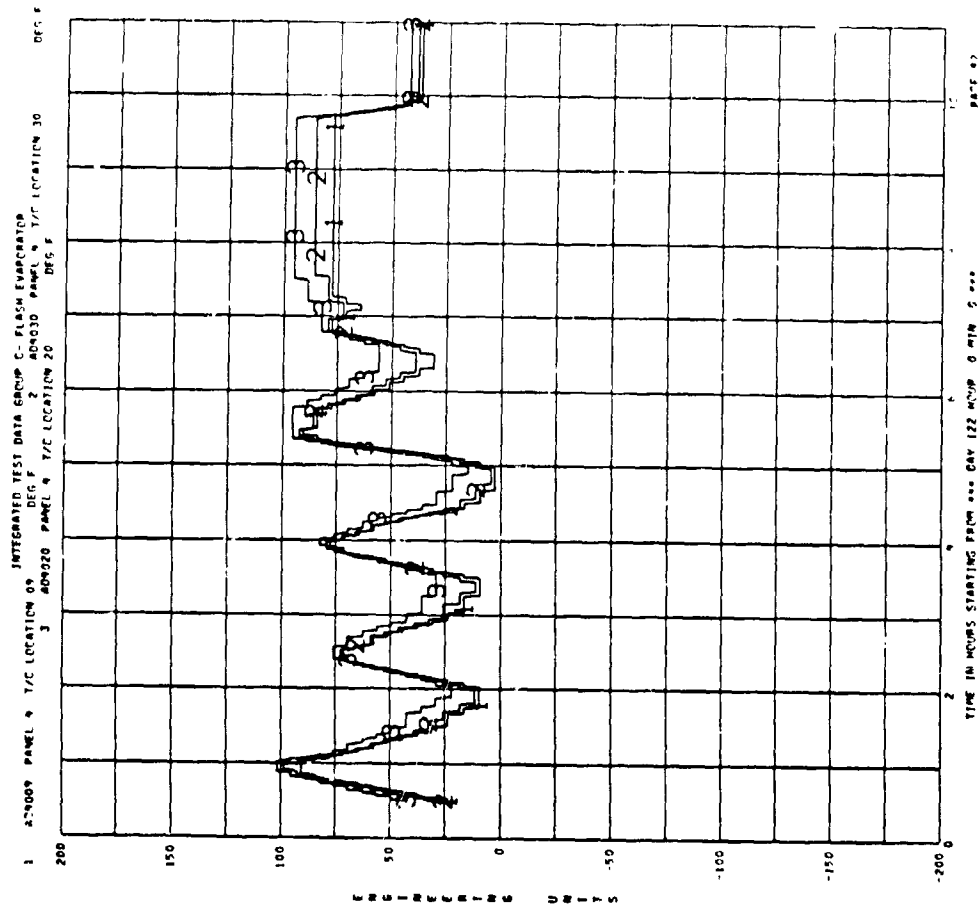
C-79



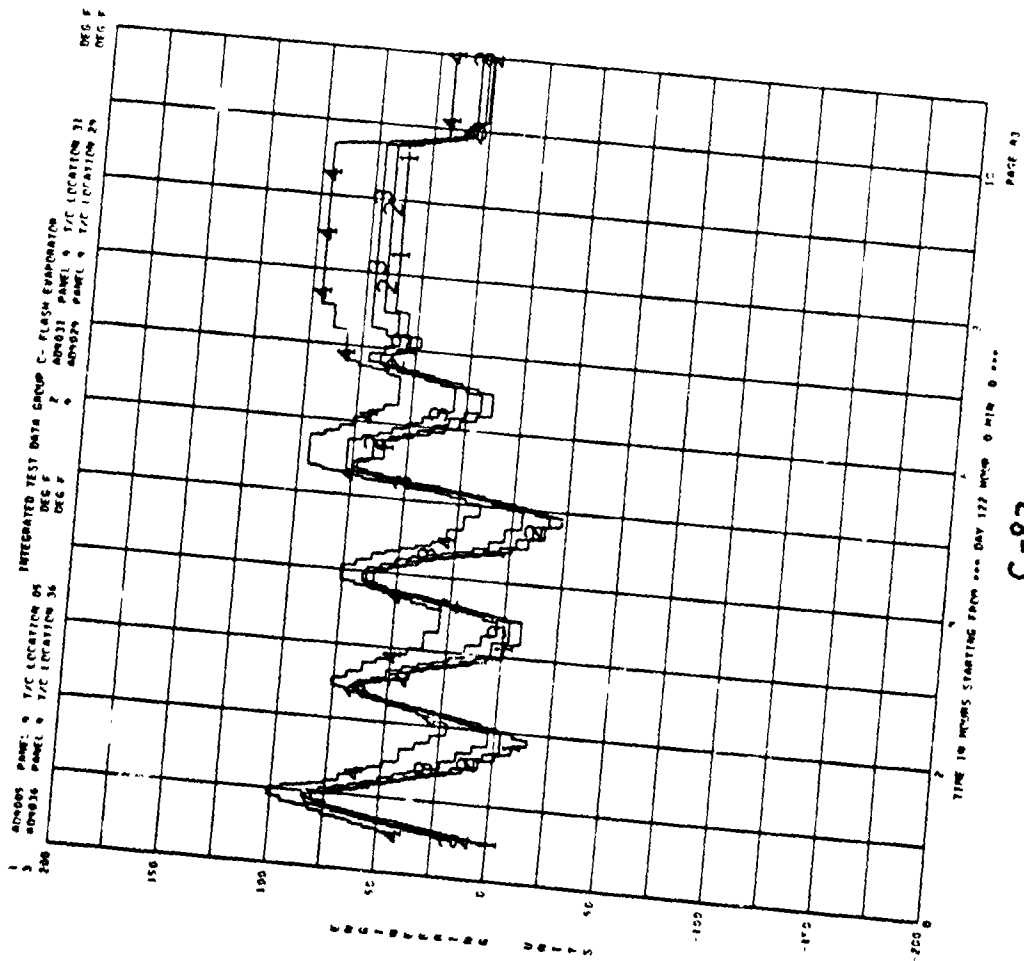
C-80



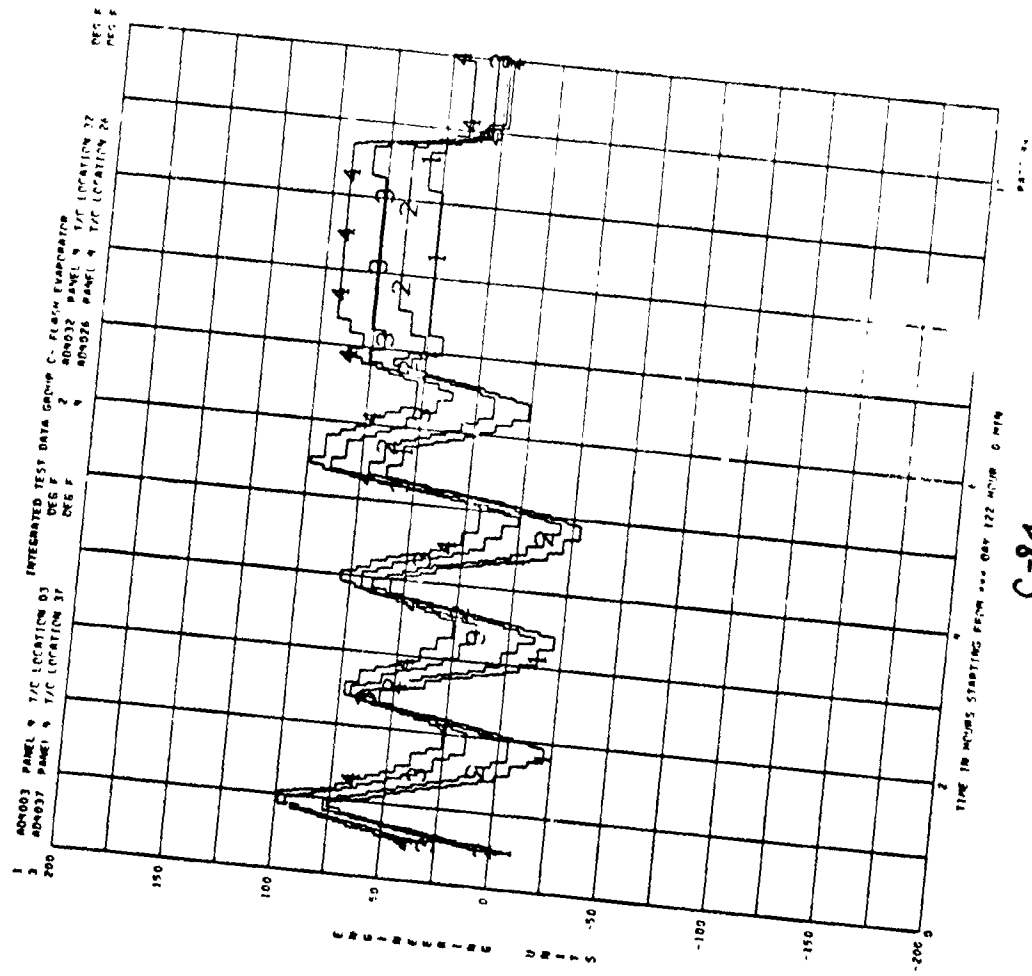
C-81



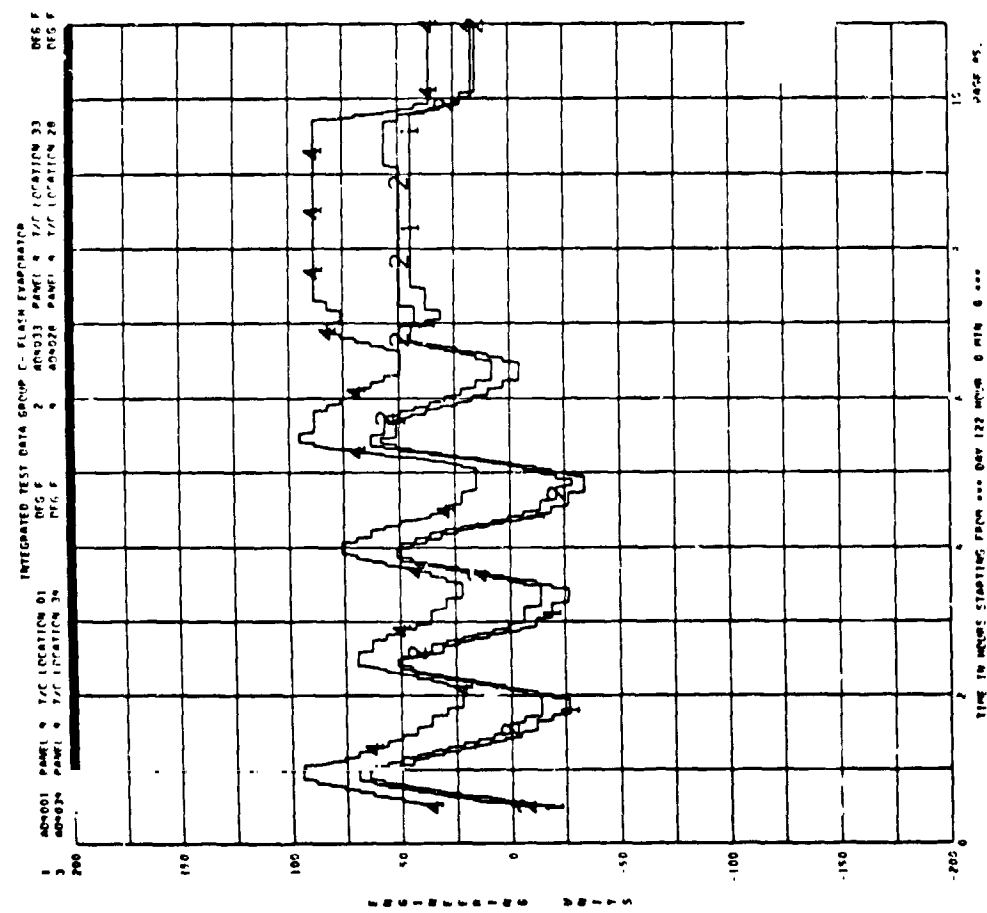
C-82



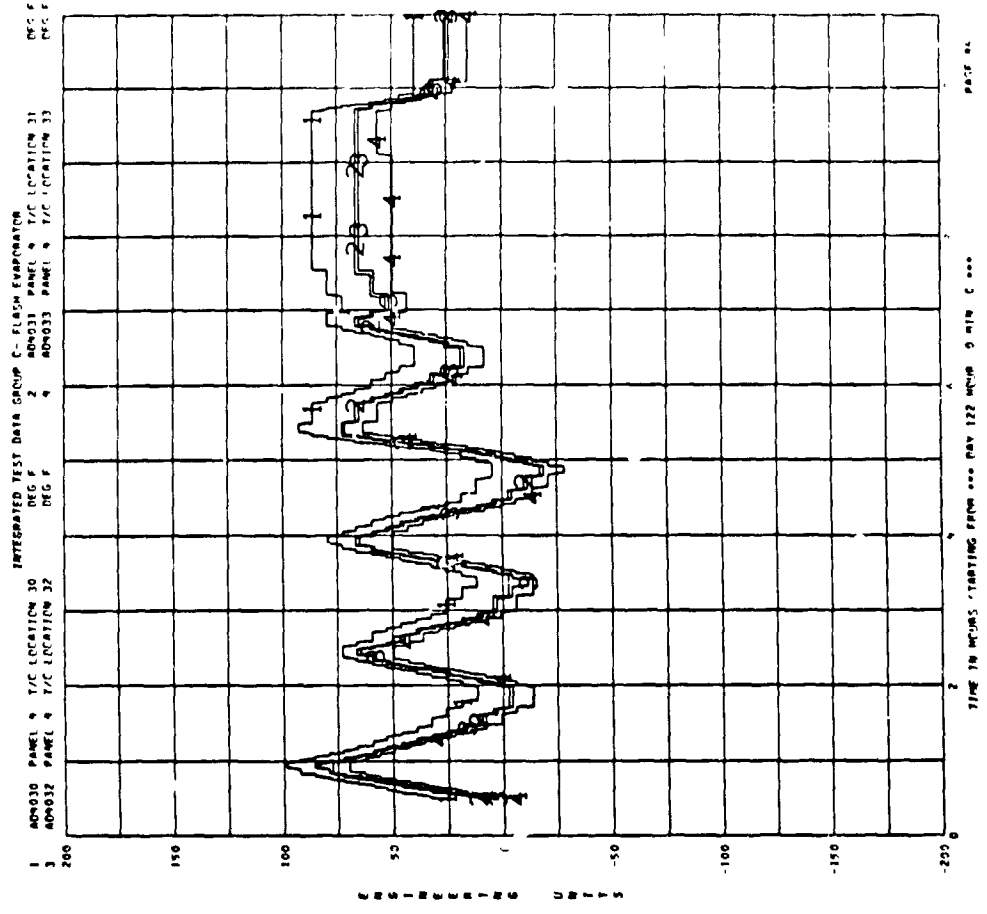
C-83



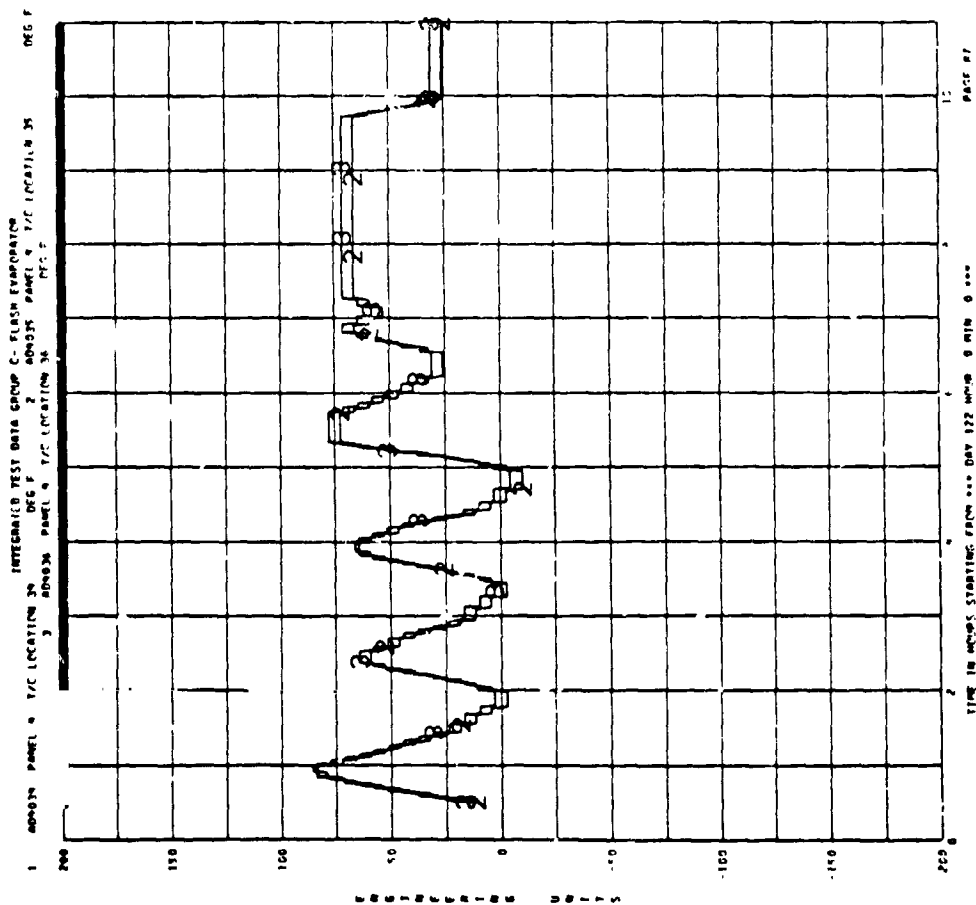
C-84



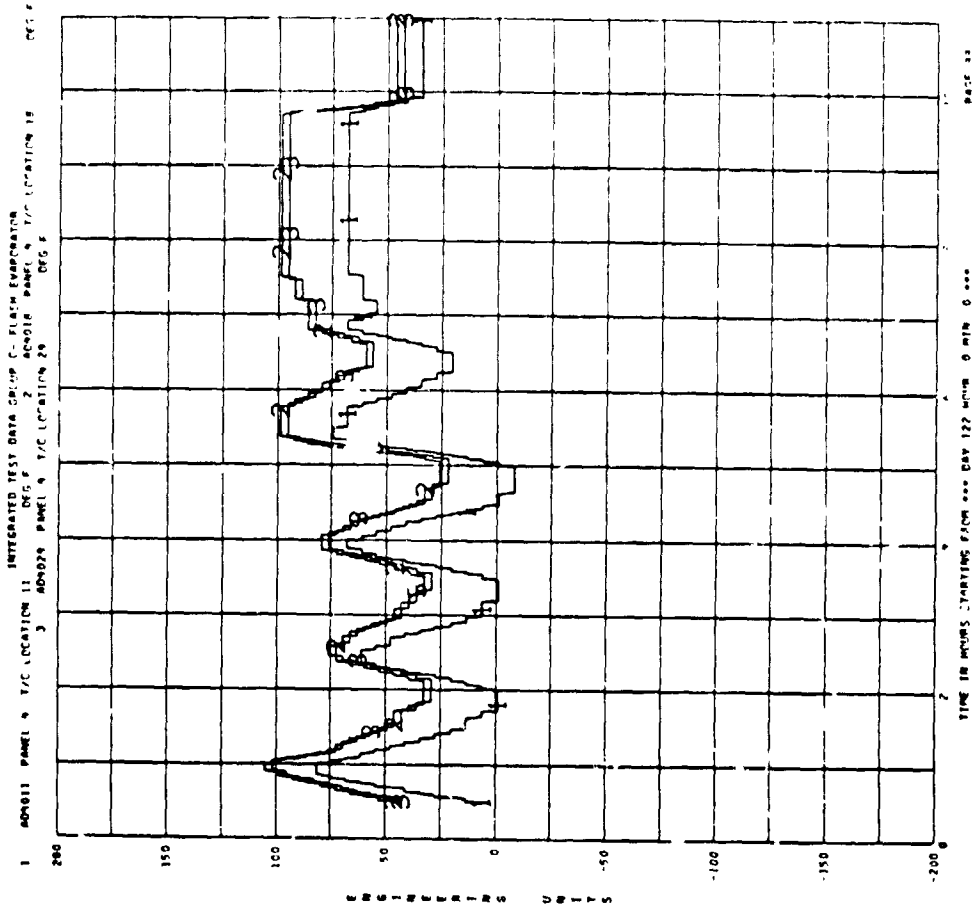
C-85



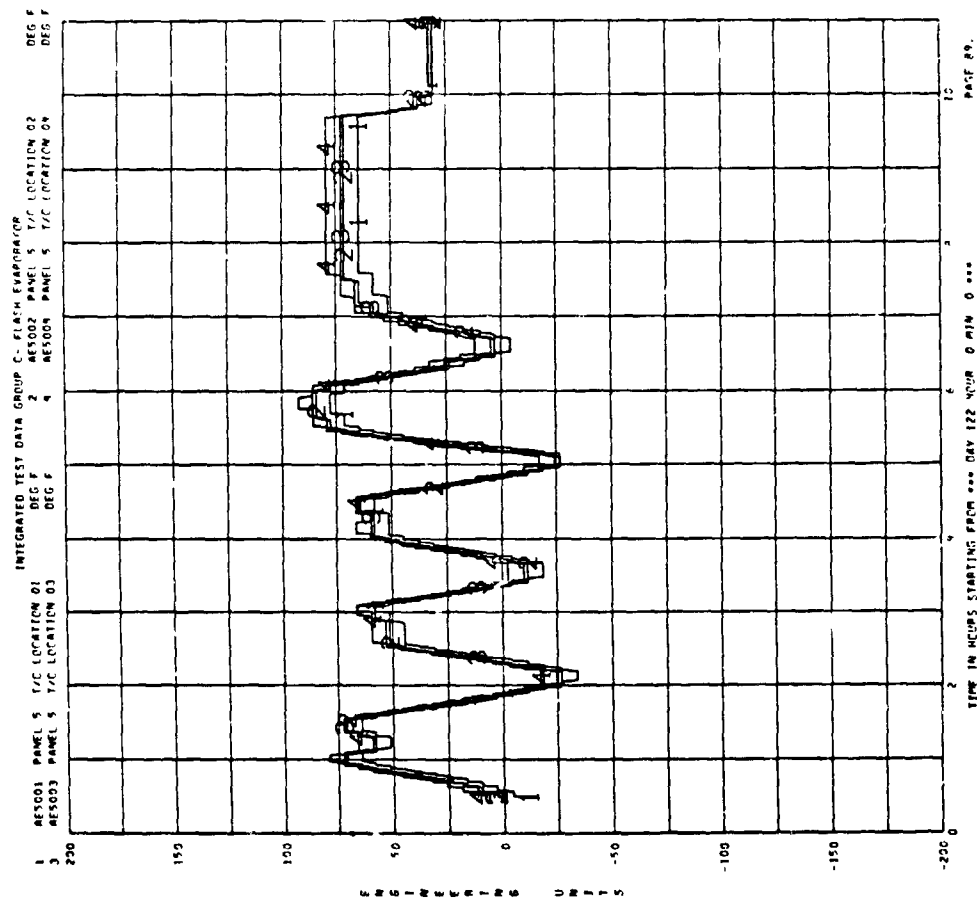
C-86



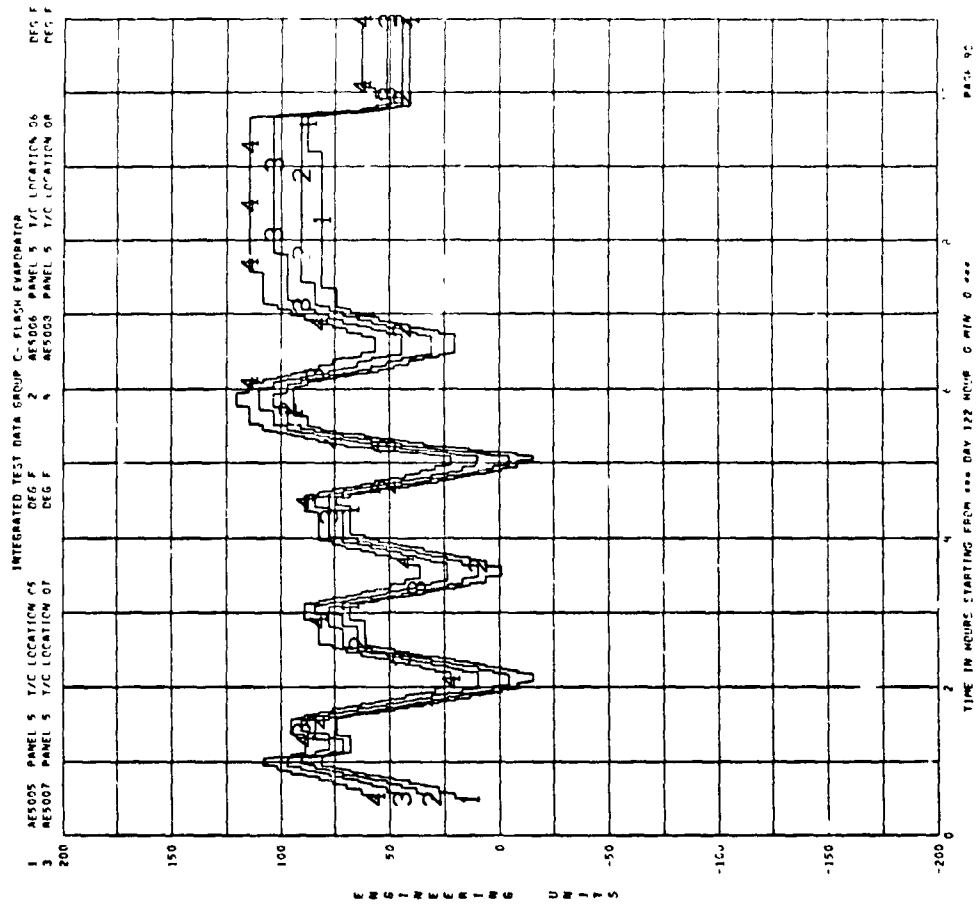
C-87



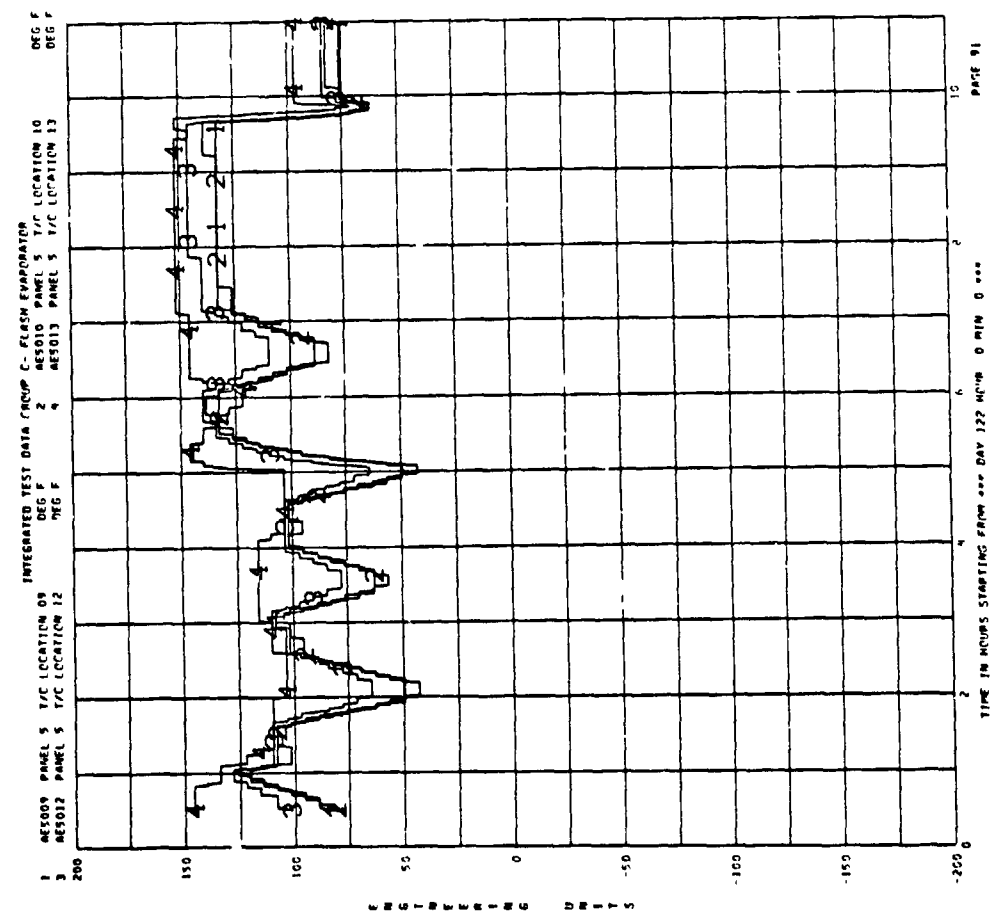
C-88



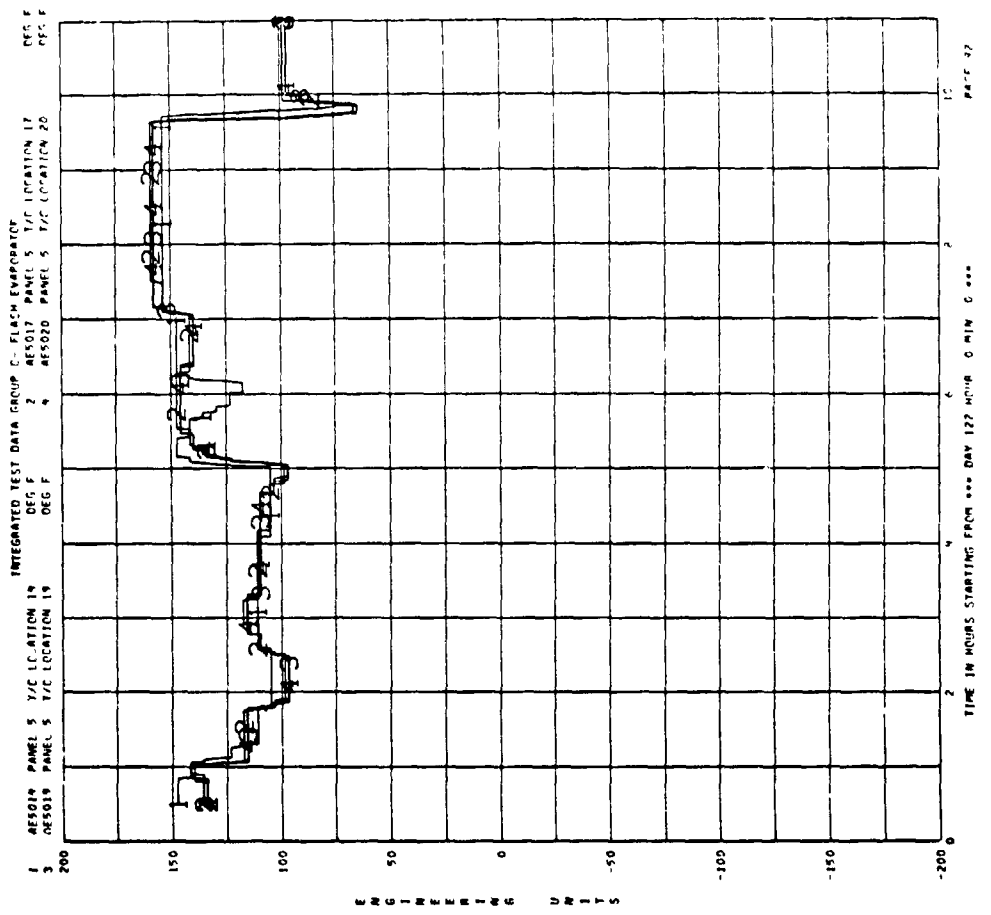
C-89



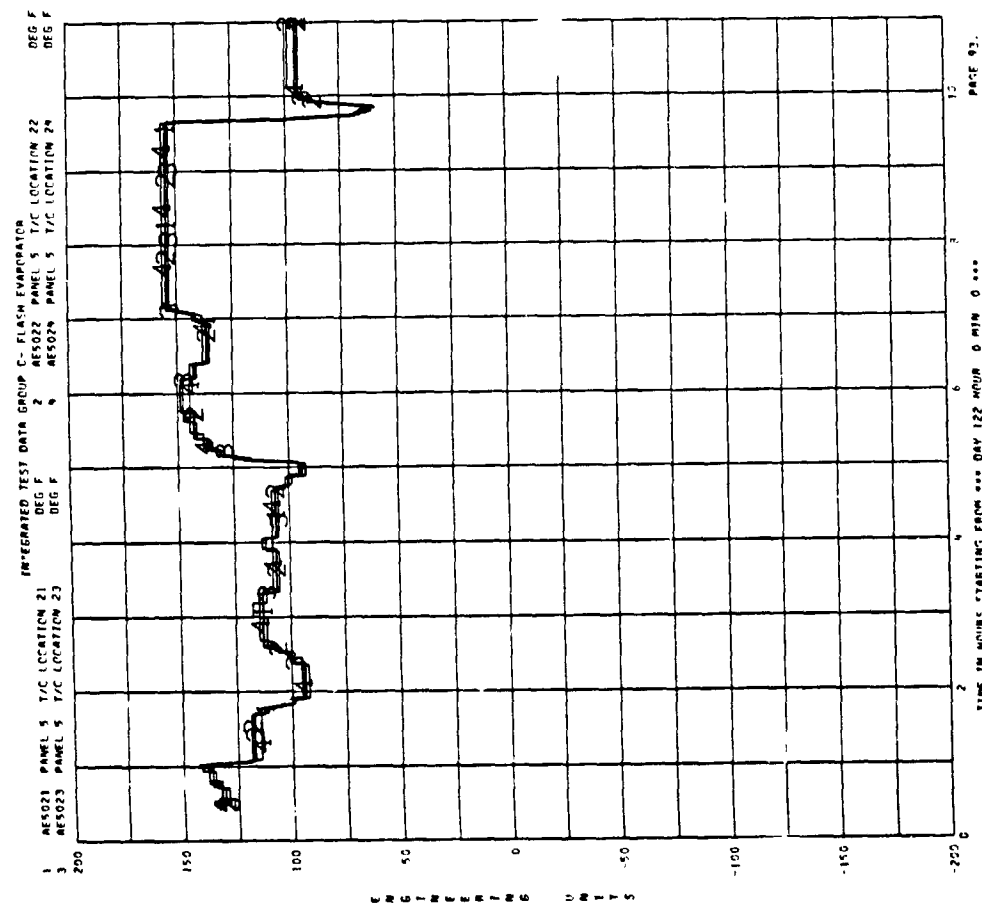
C-90



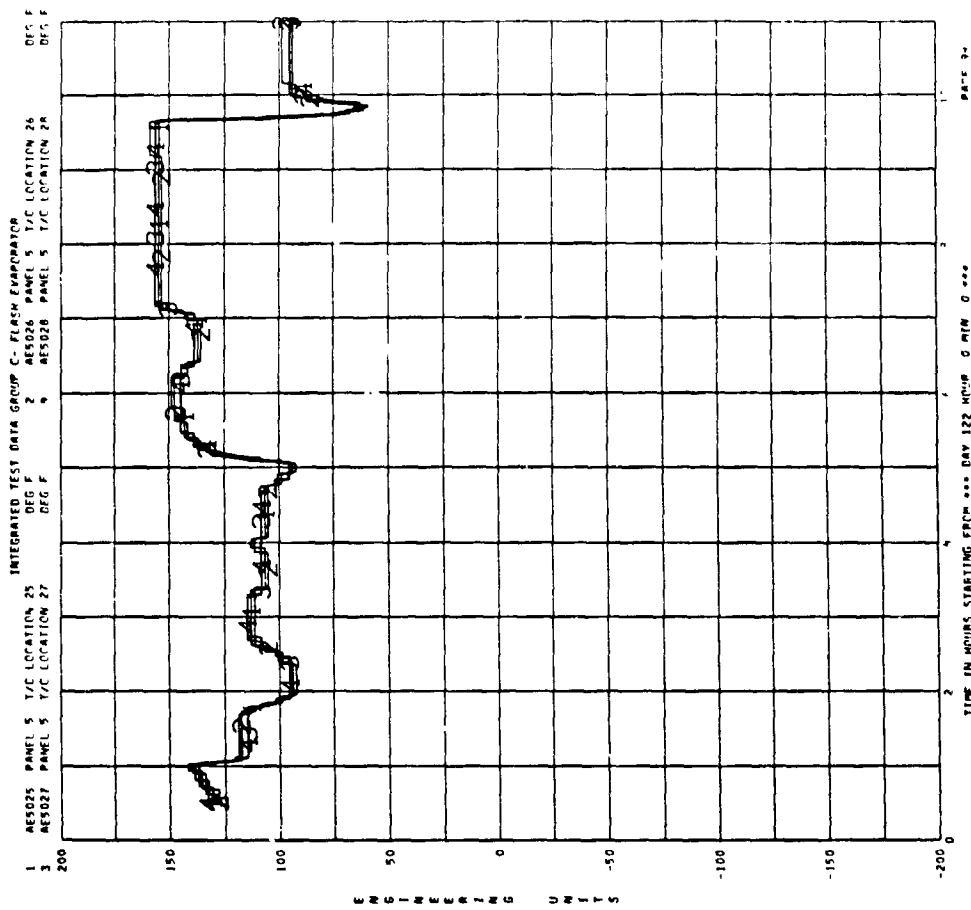
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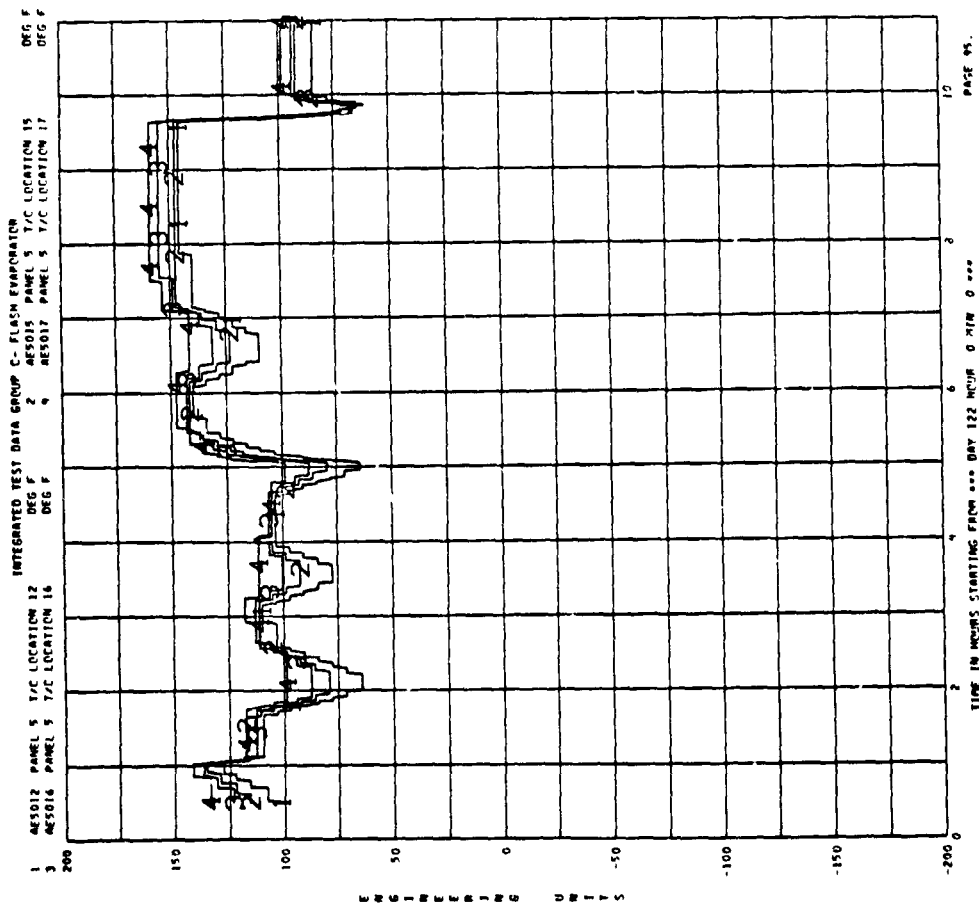
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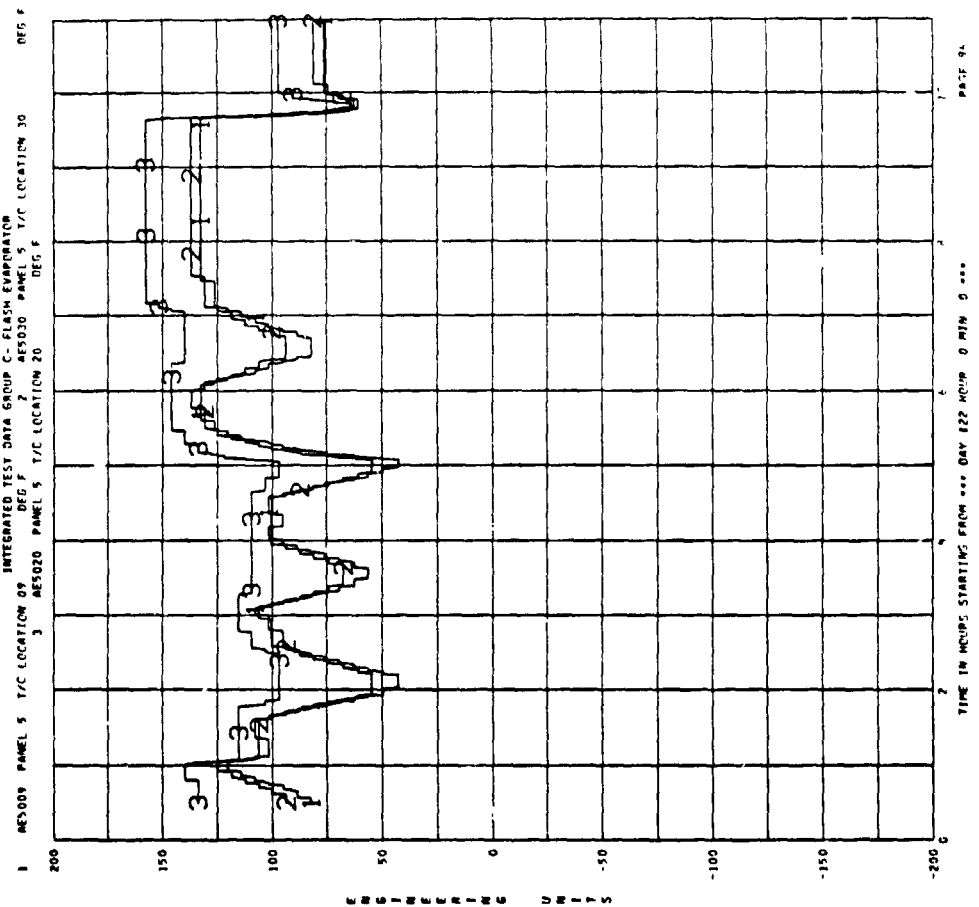
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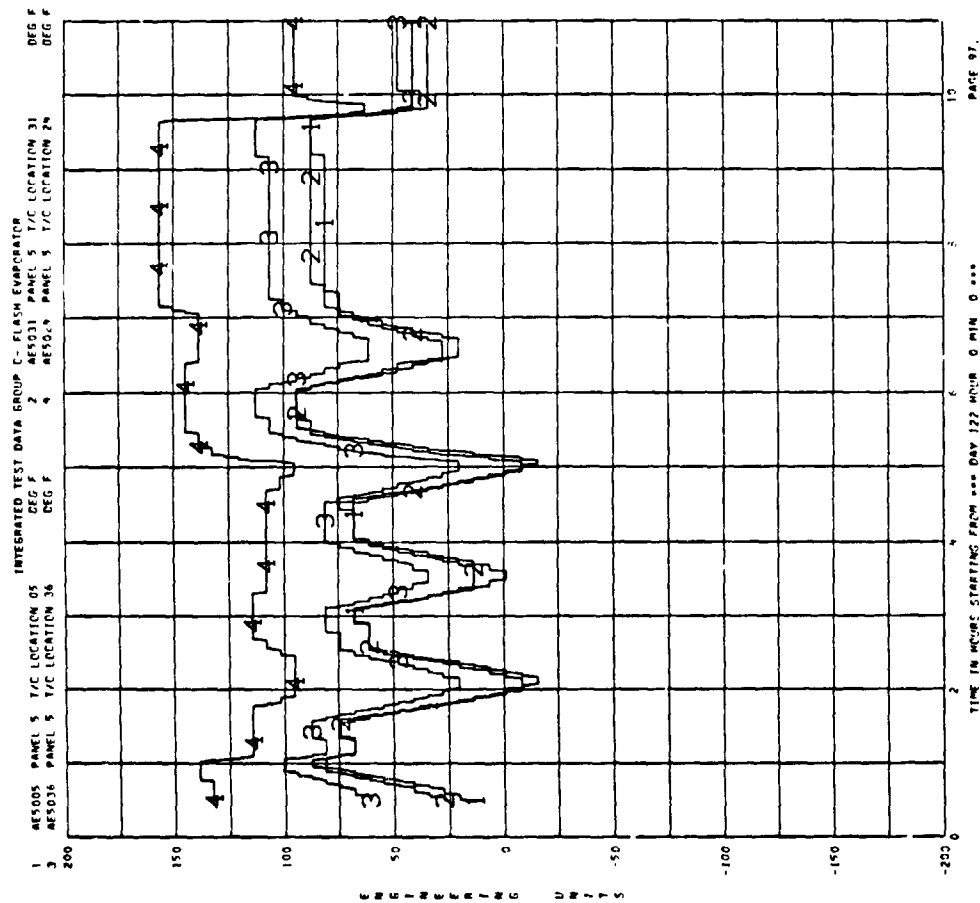
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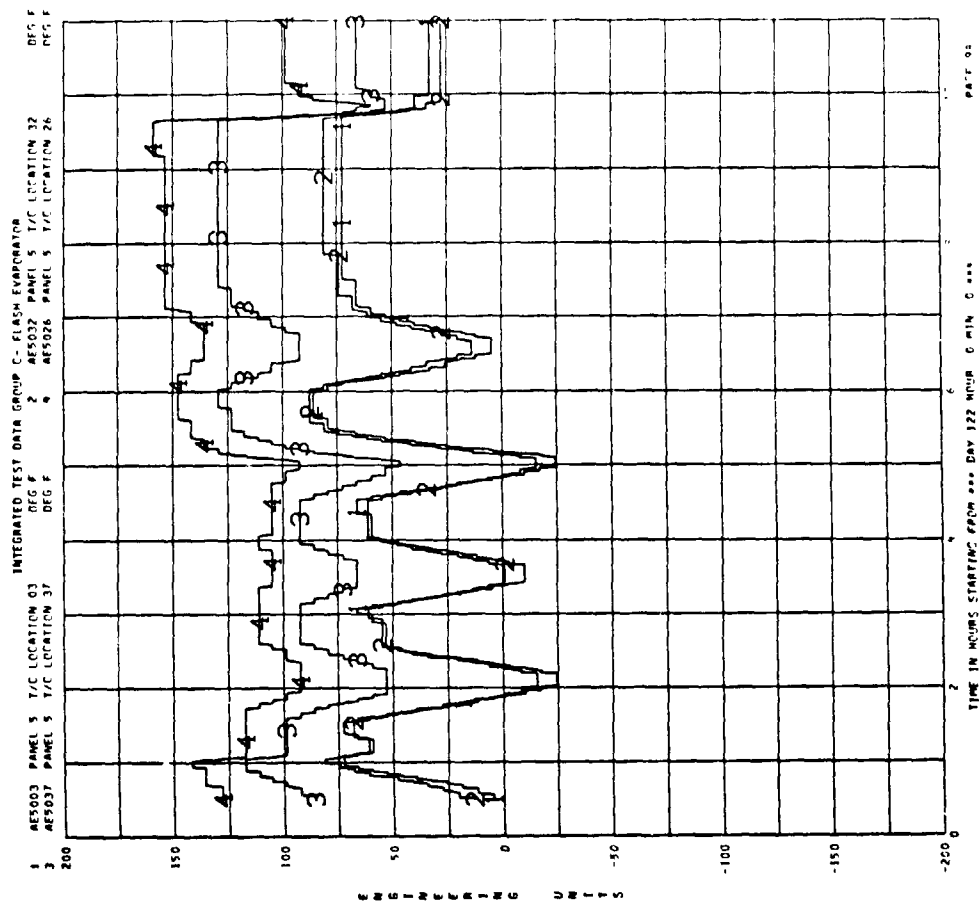
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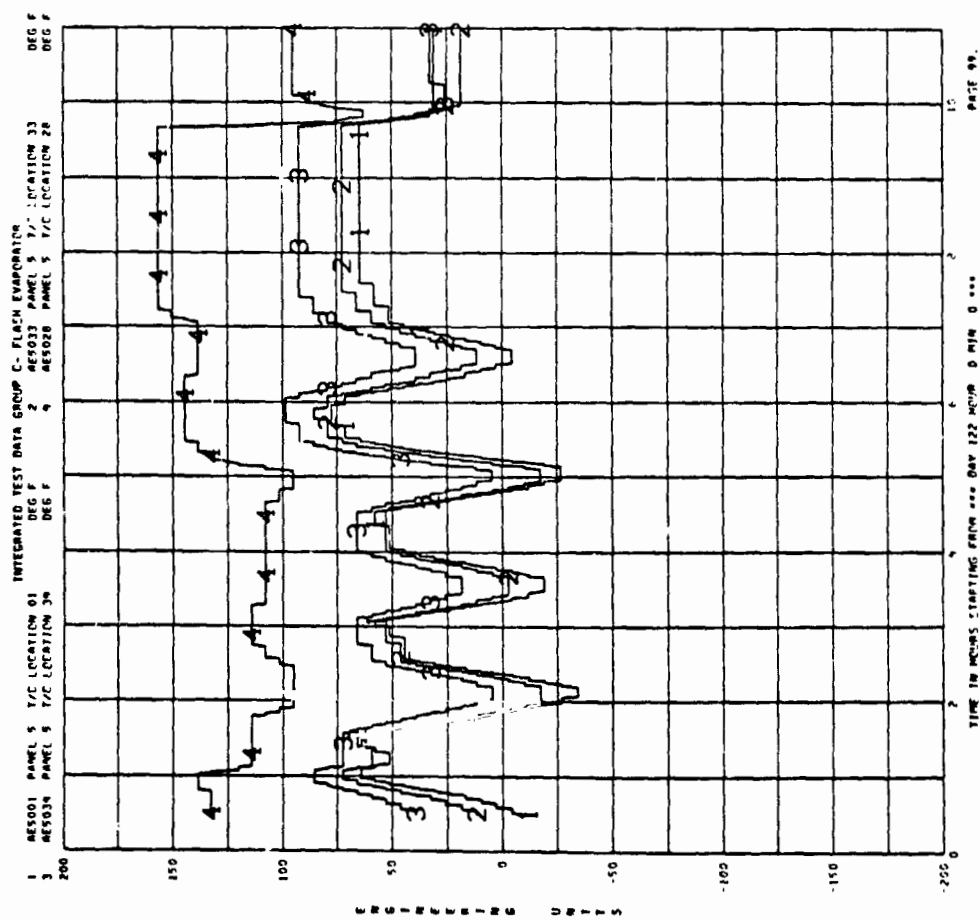
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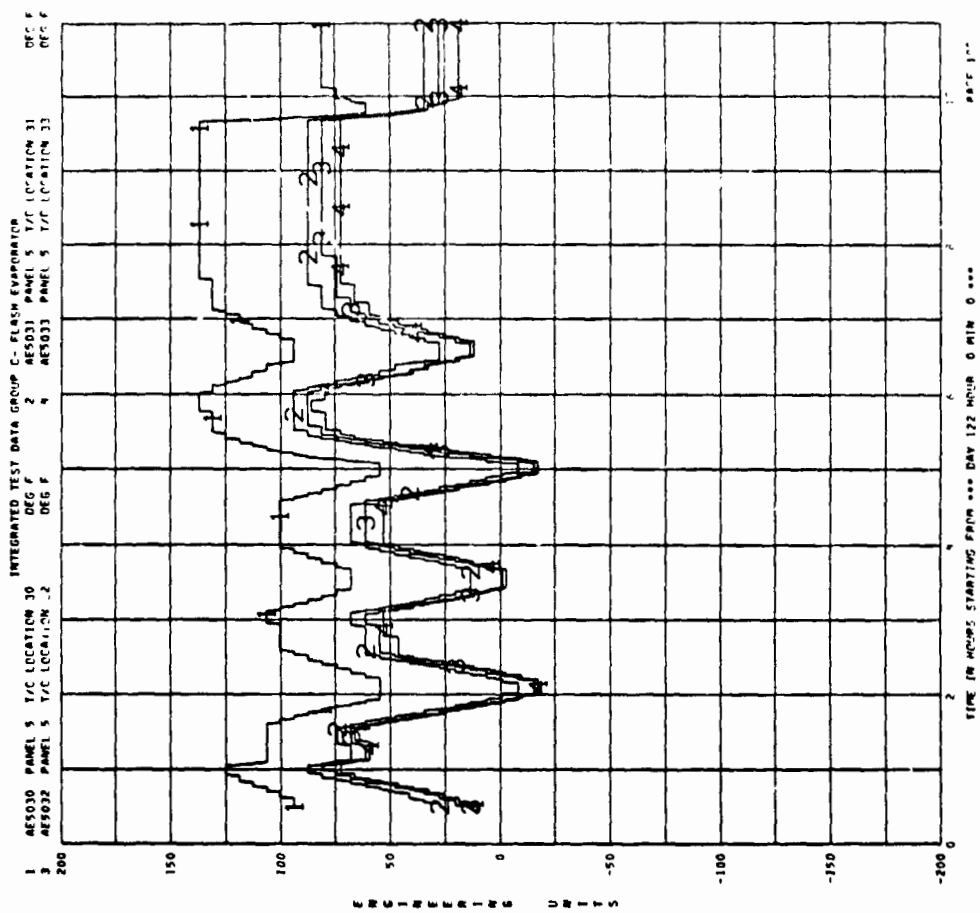
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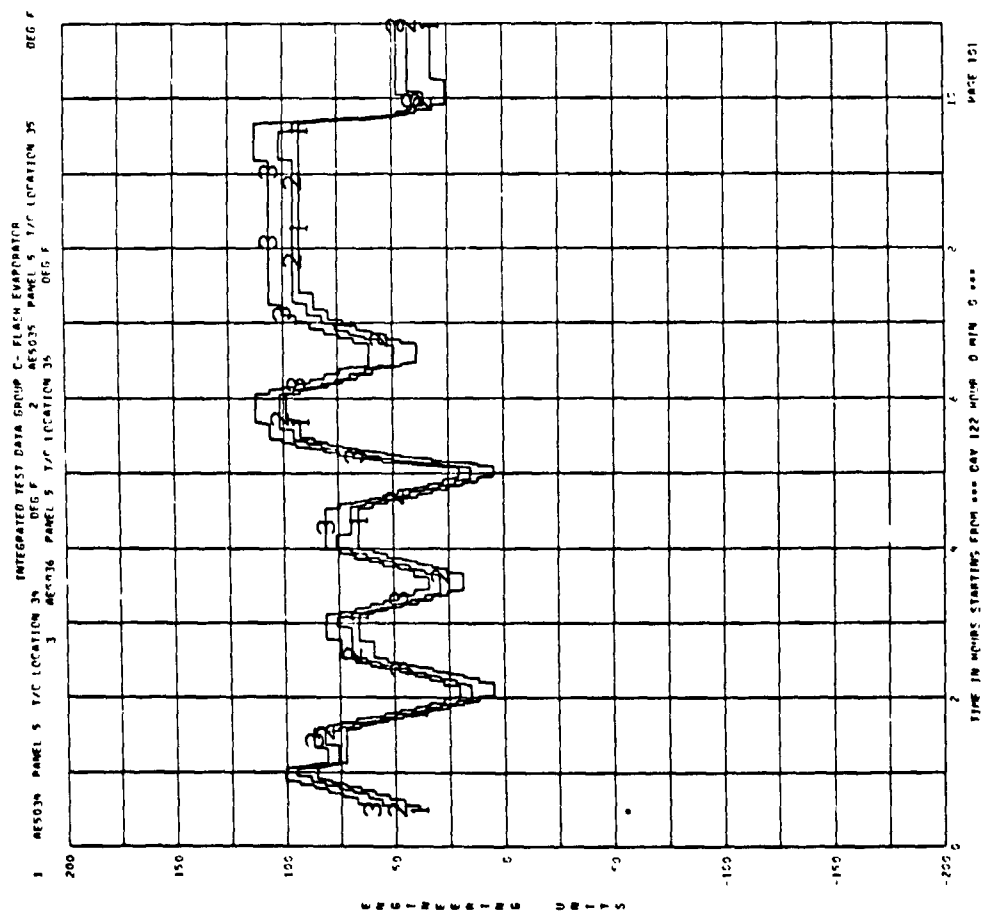
C-98



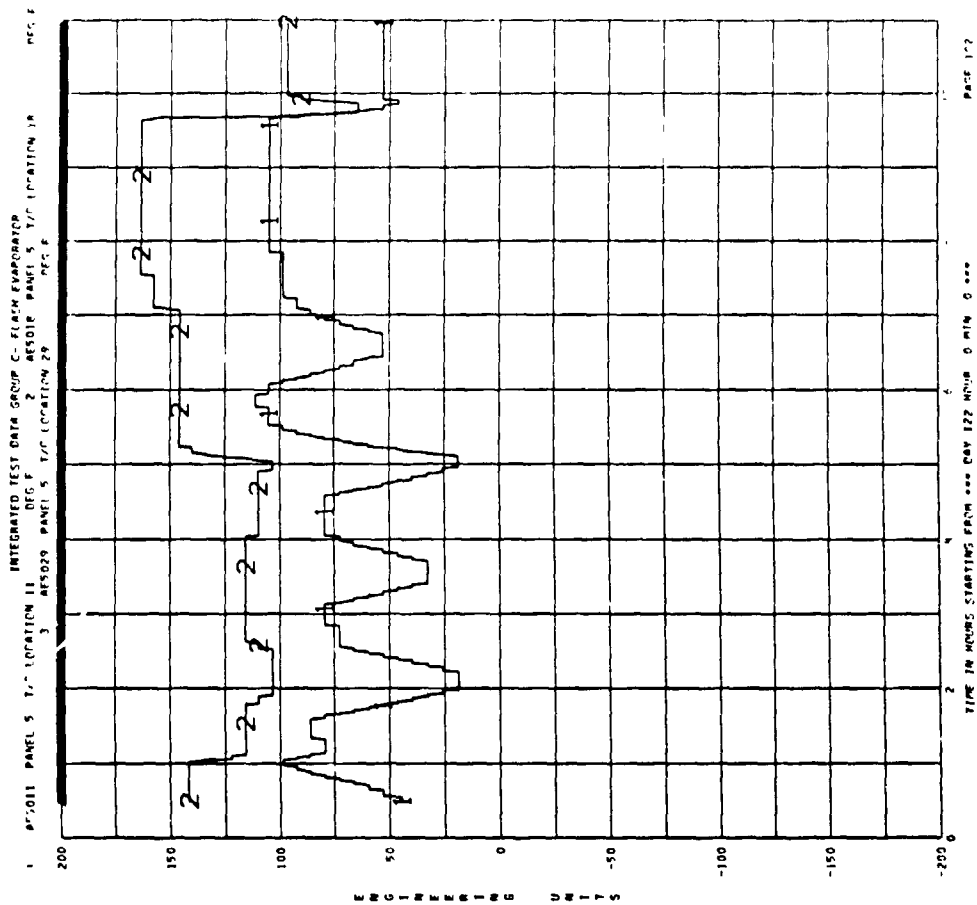
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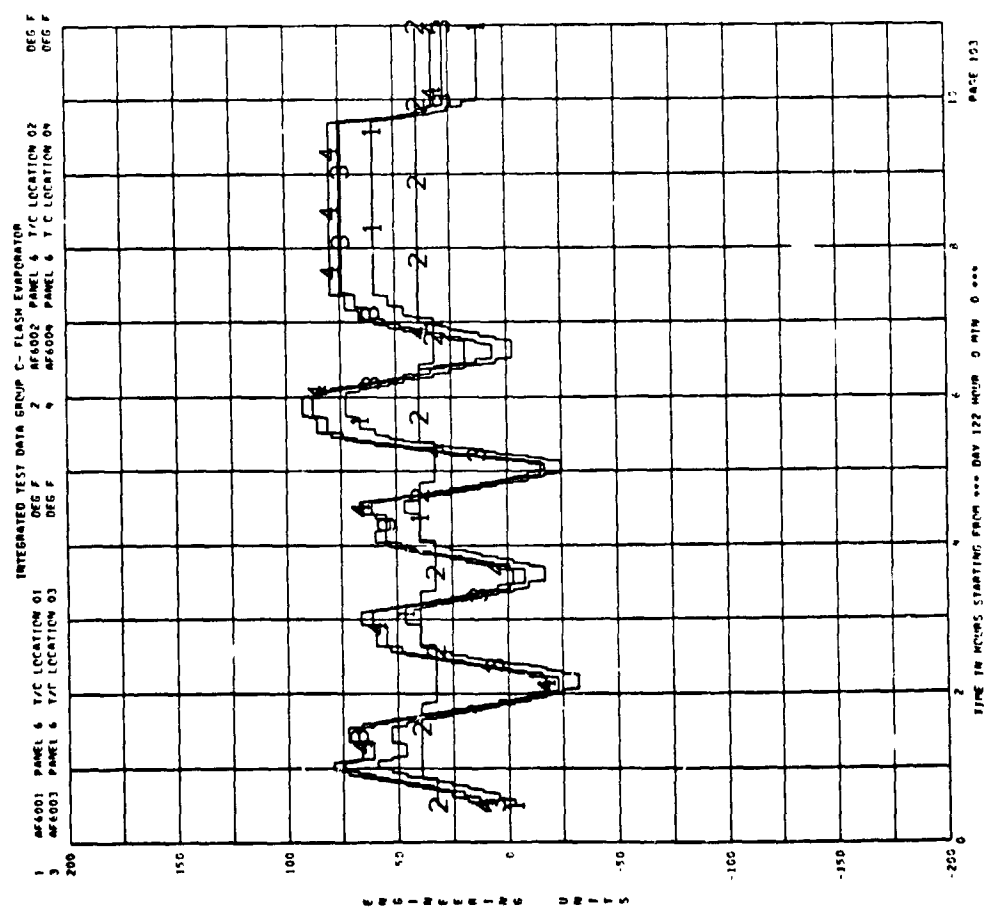
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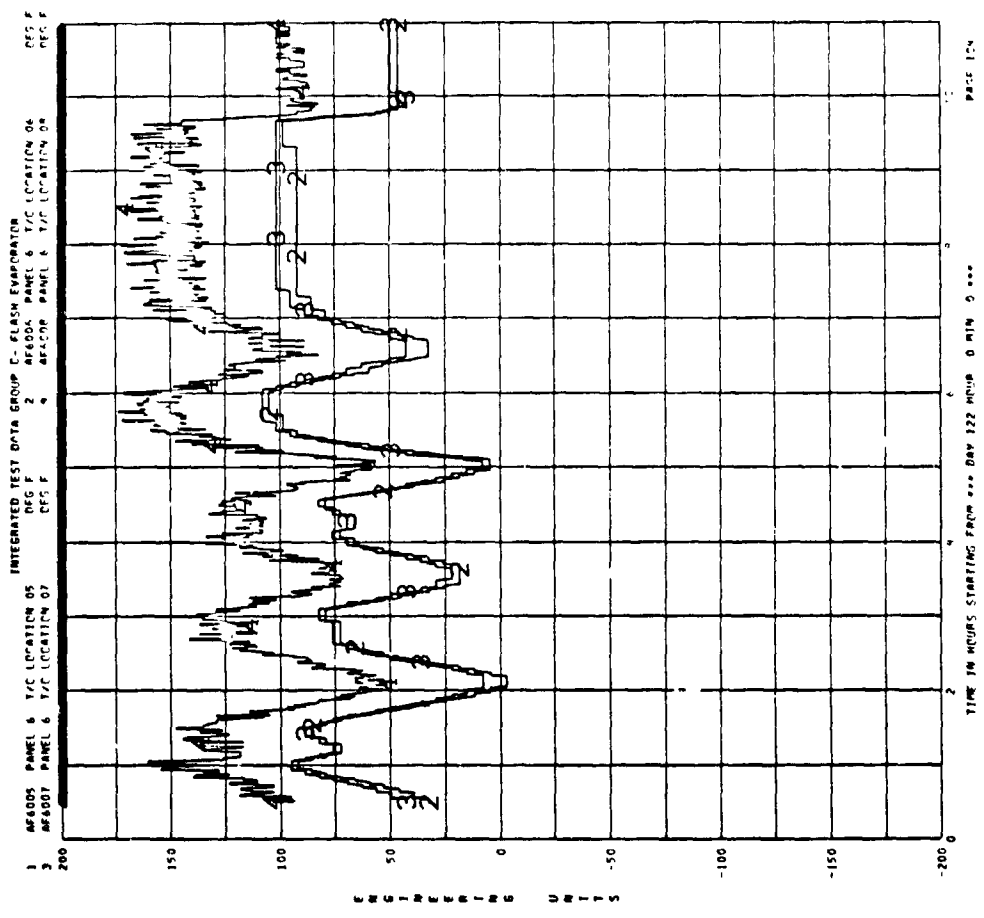
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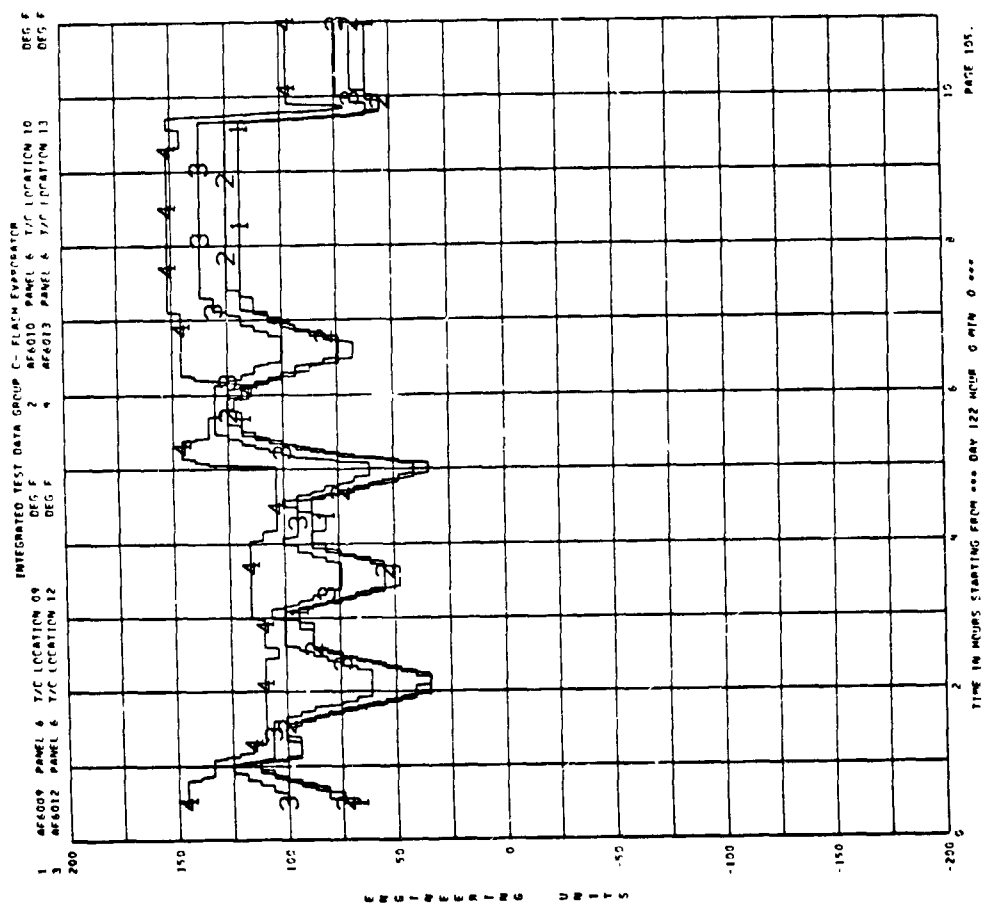
C-102



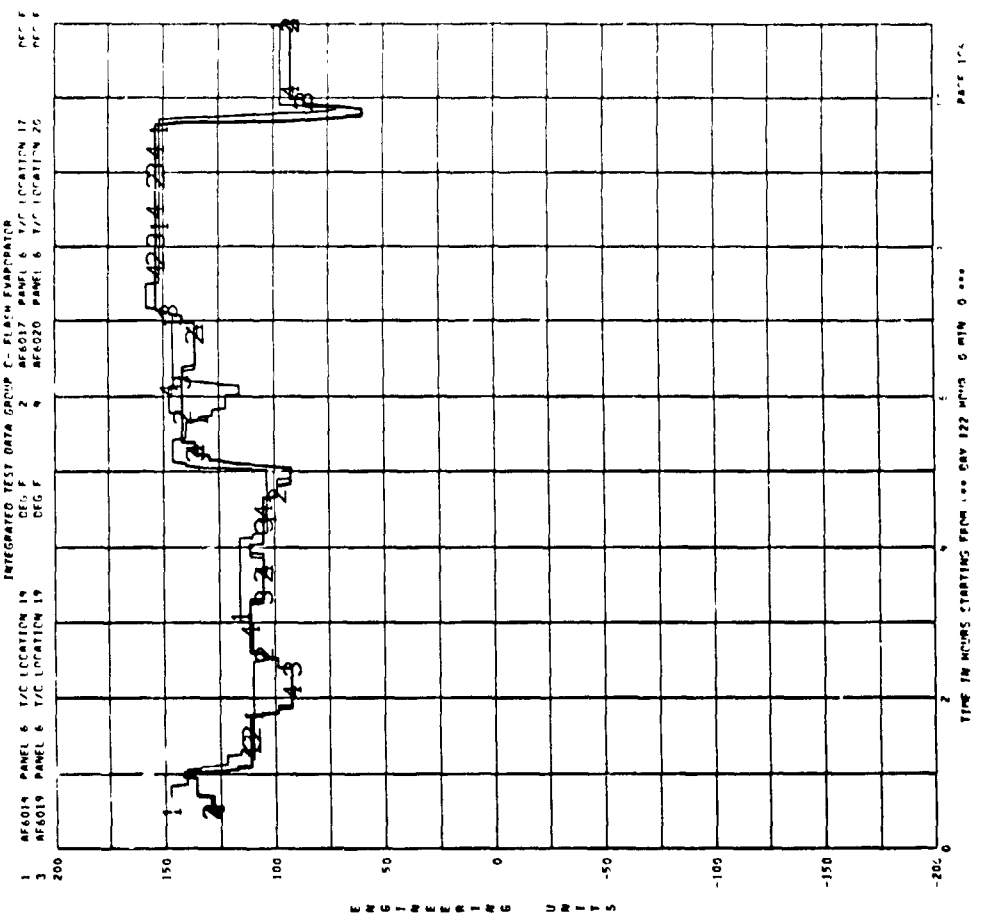
C-103



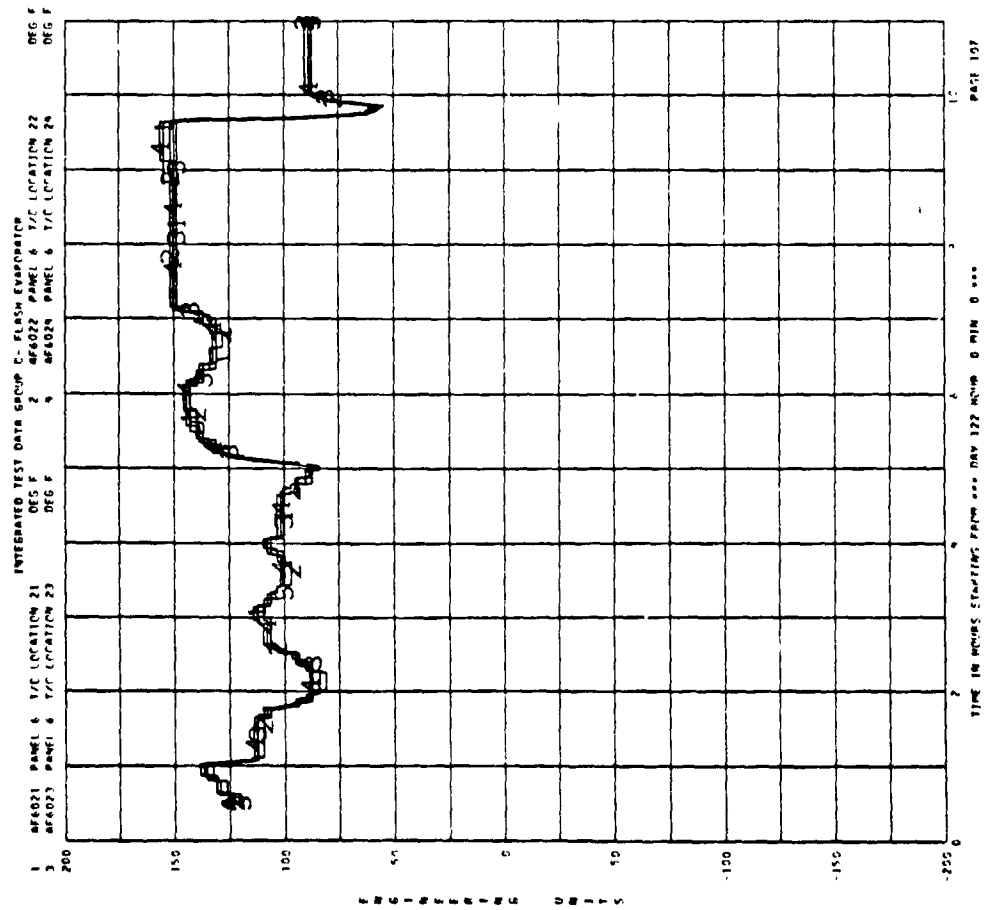
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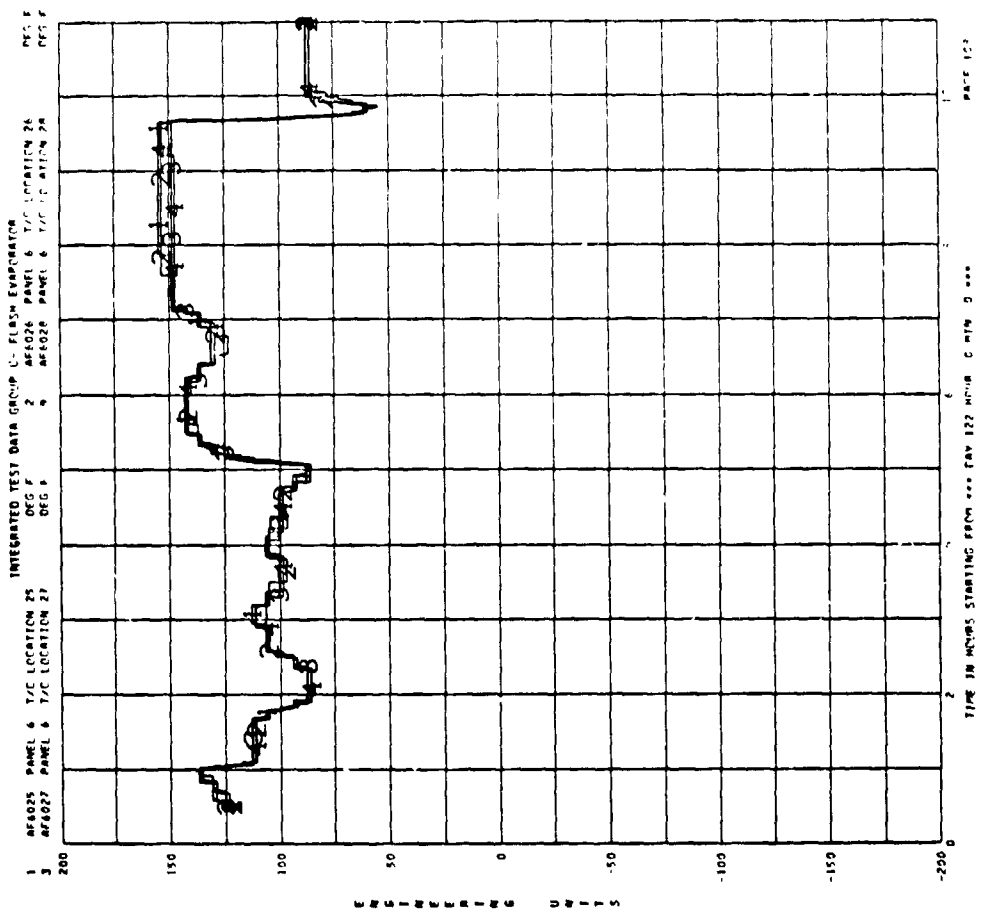
C-105



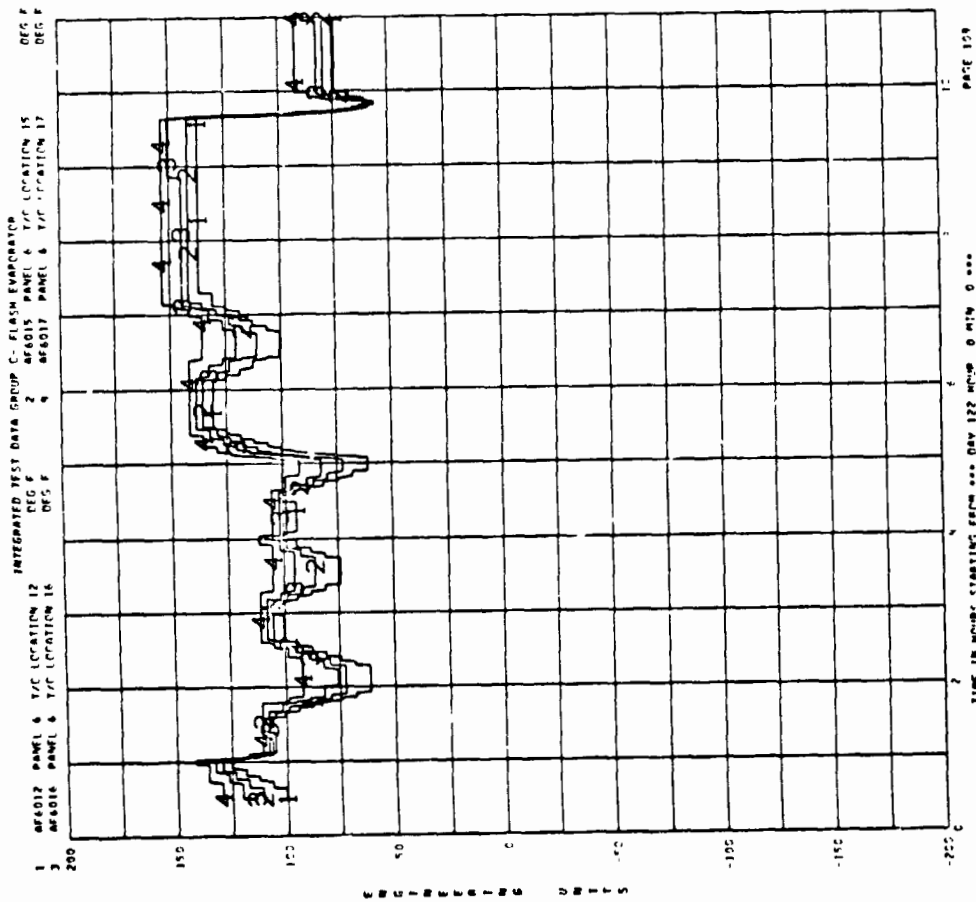
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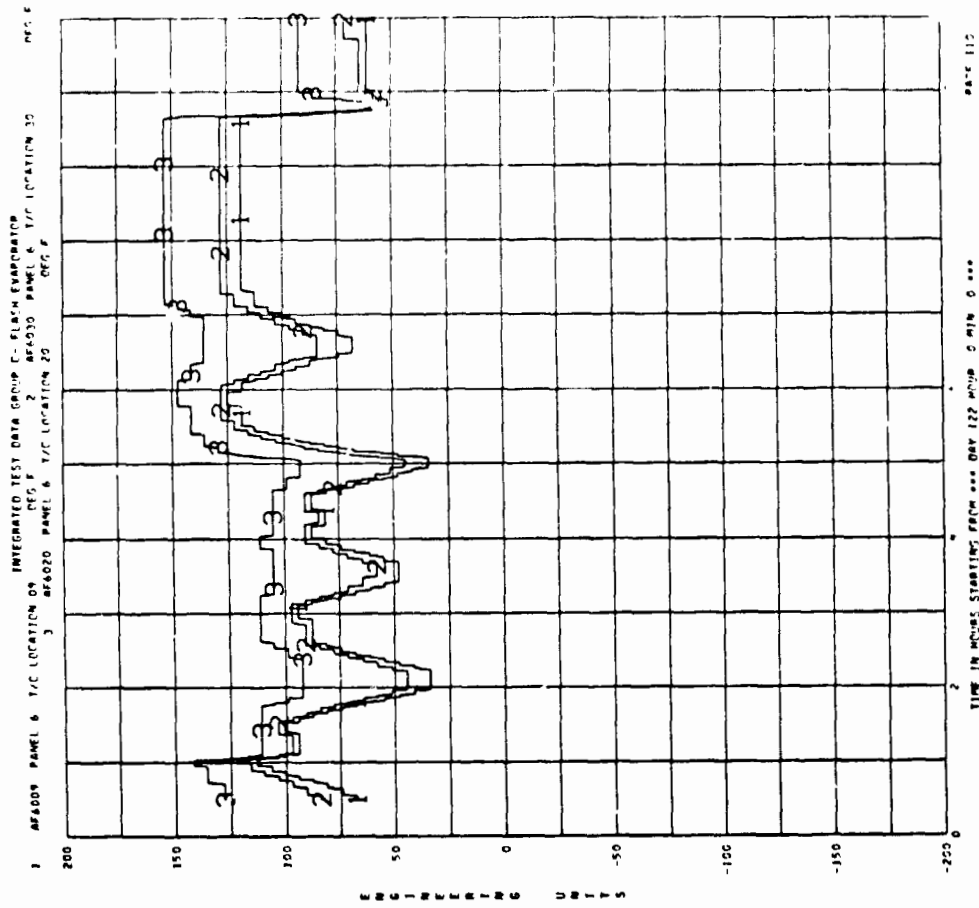
C-107



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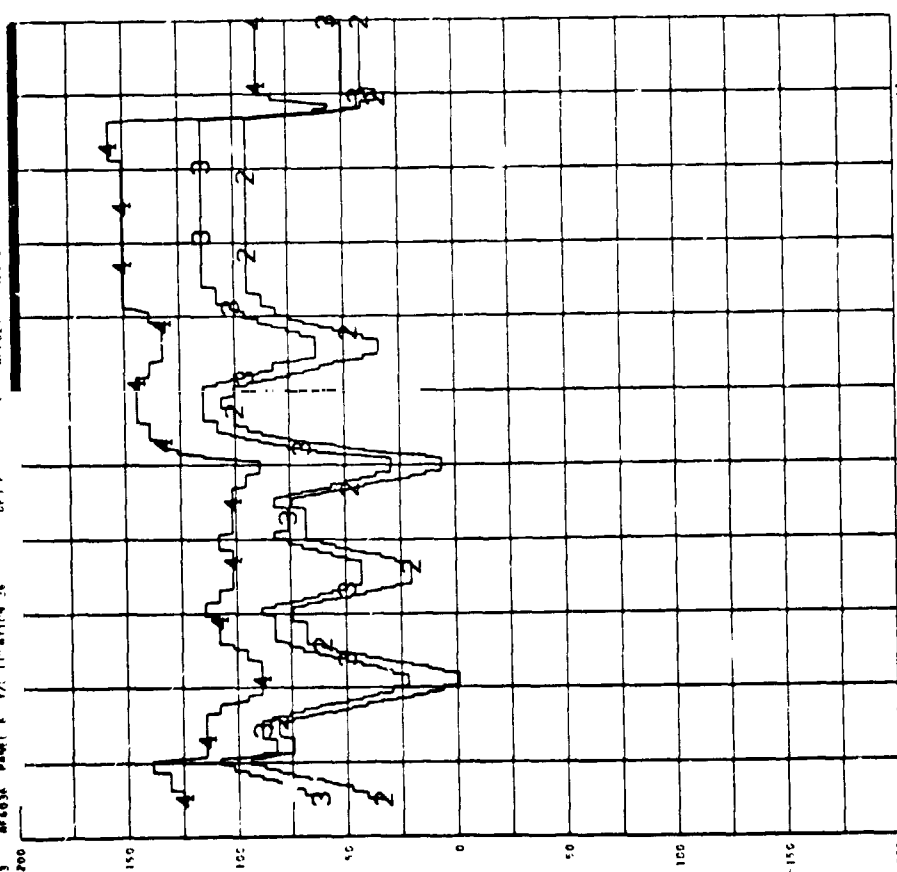
C-109



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INTEGRATED TEST DATA GROUP C- FLASH EVAPORATION

1 AF6031 PANEL 6 T/C LOCATION 31 DEG F
2 AF6031 PANEL 6 T/C LOCATION 26 DEG F
3 AF6031 PANEL 6 T/C LOCATION 26 DEG F



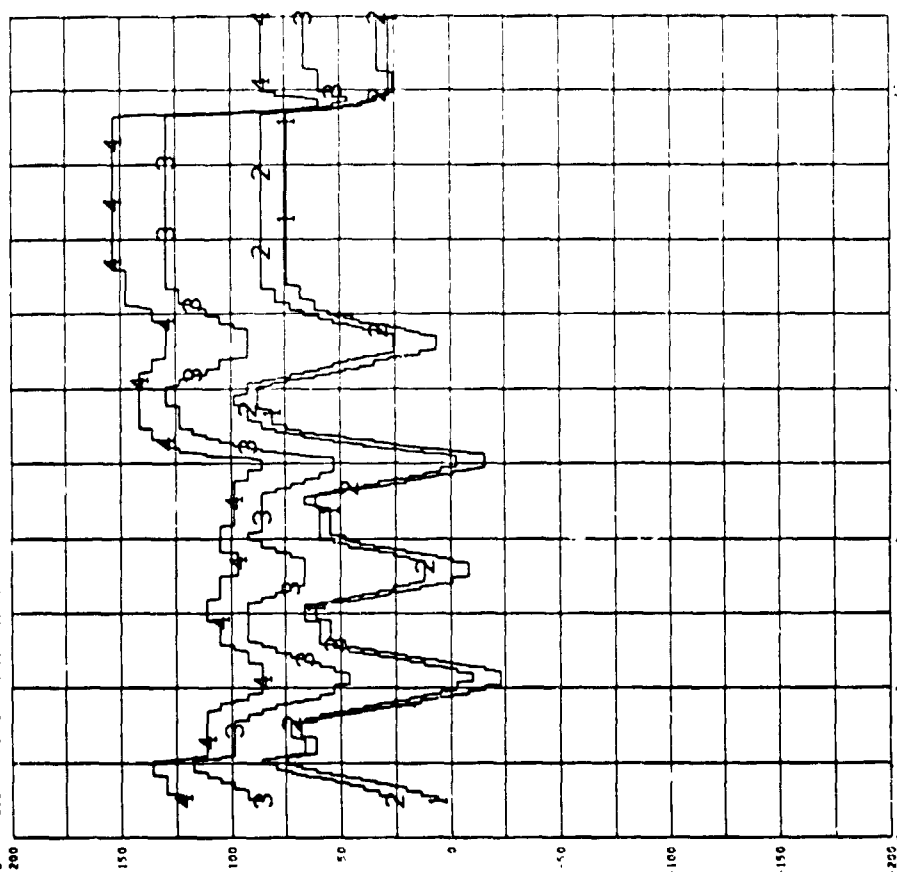
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TIME IN MINUTES STARTING FROM ... DAY 122 MIN 0 MIN 0 ...

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INTEGRATED TEST DATA GROUP C- FLASH EVAPORATION

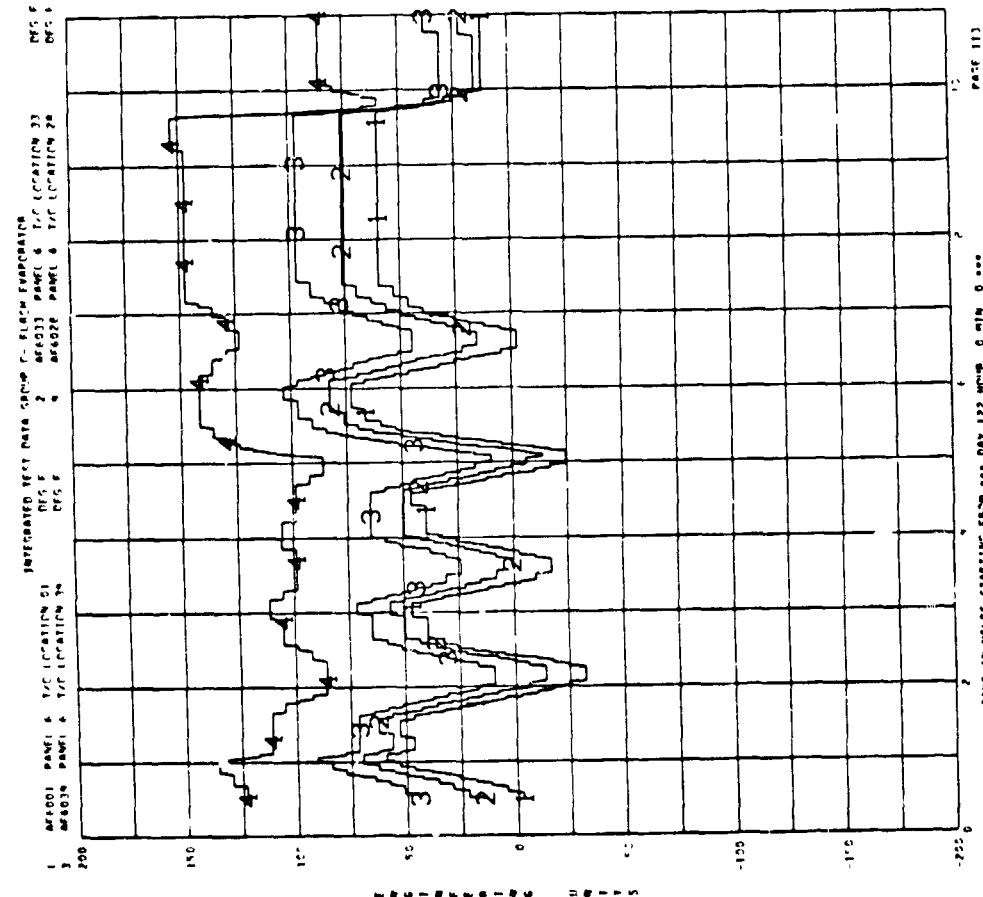
1 AF6032 PANEL 6 T/C LOCATION 32 DEG F
2 AF6032 PANEL 6 T/C LOCATION 26 DEG F
3 AF6032 PANEL 6 T/C LOCATION 26 DEG F



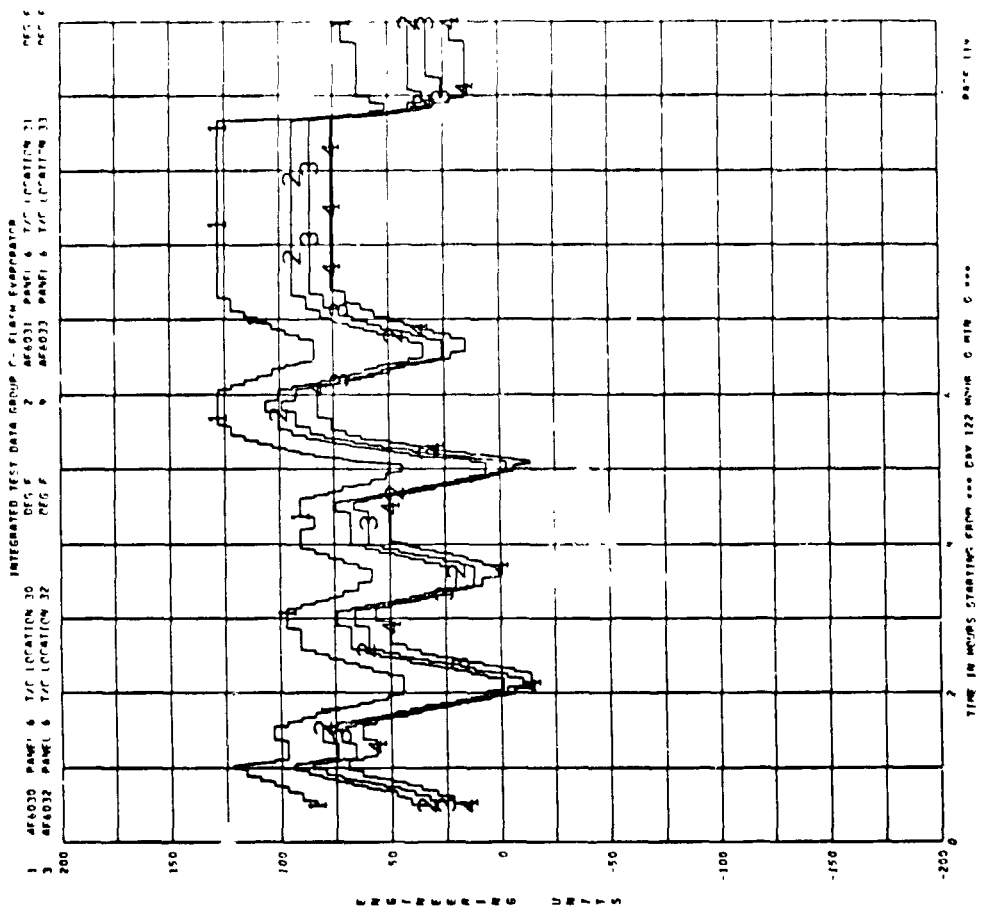
PAGE 112

TIME IN MINUTES STARTING FROM ... DAY 122 MIN 0 MIN 0 ...

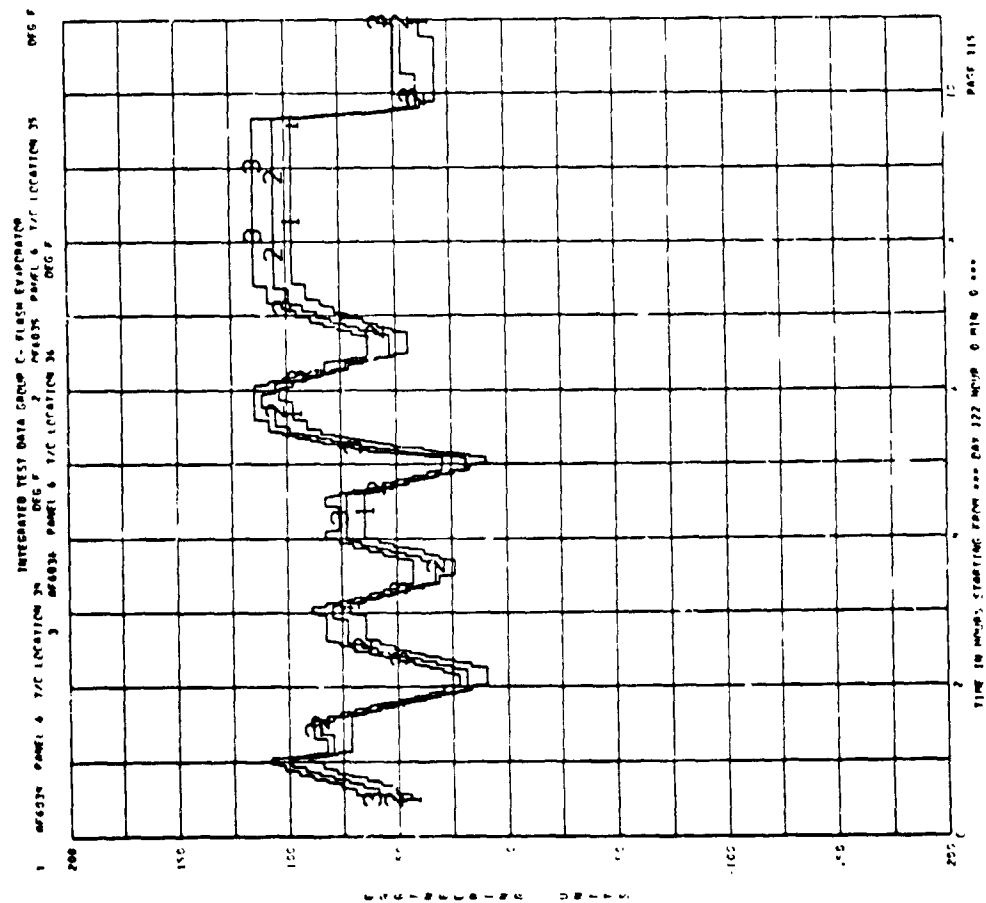
C-112



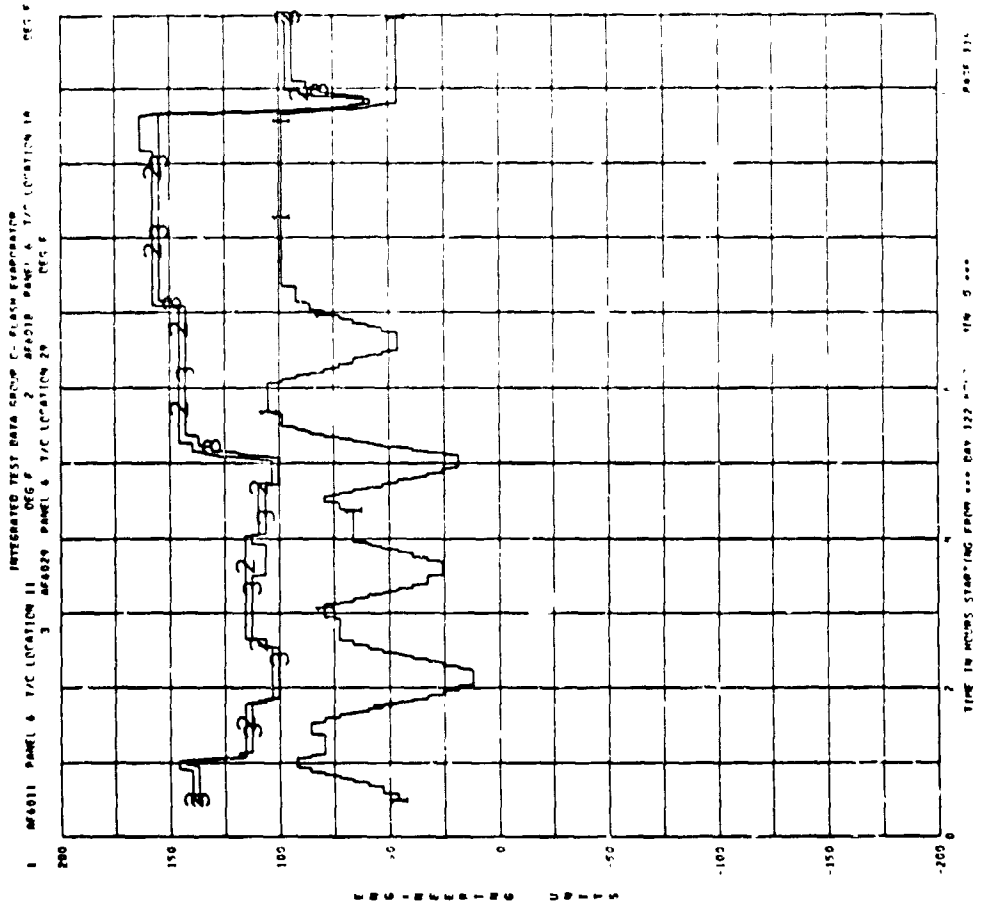
C-113



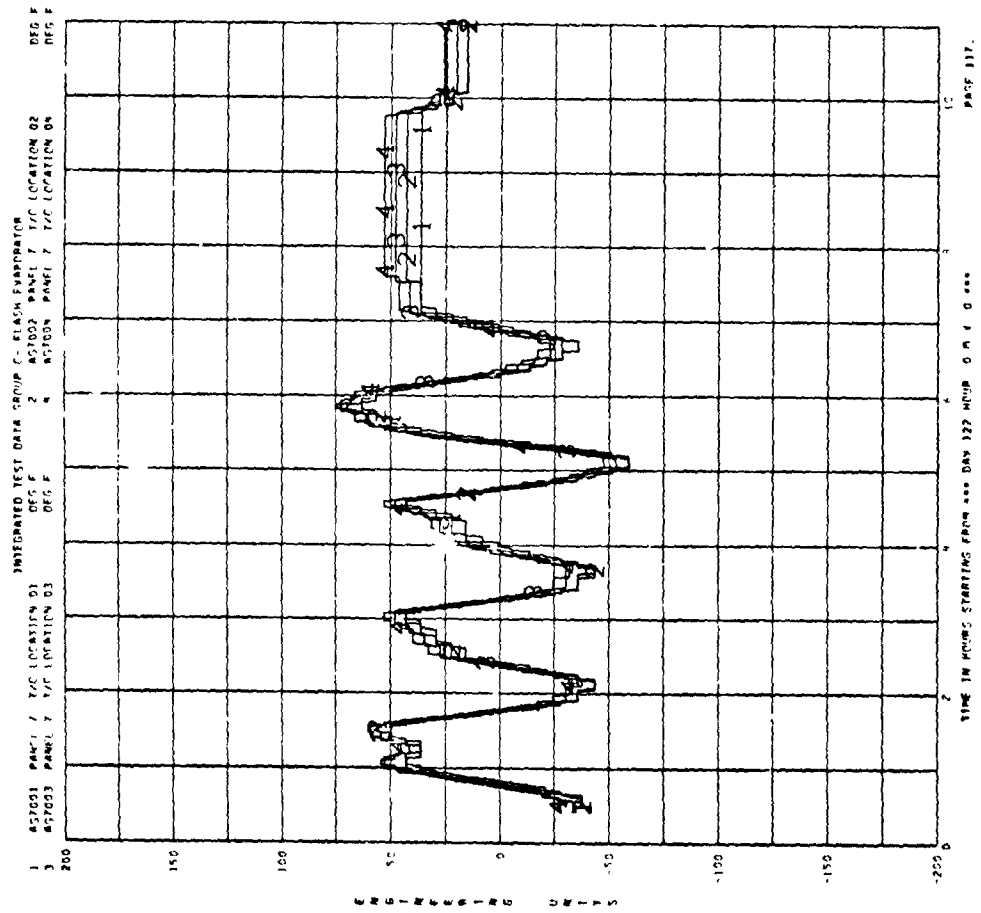
C-114



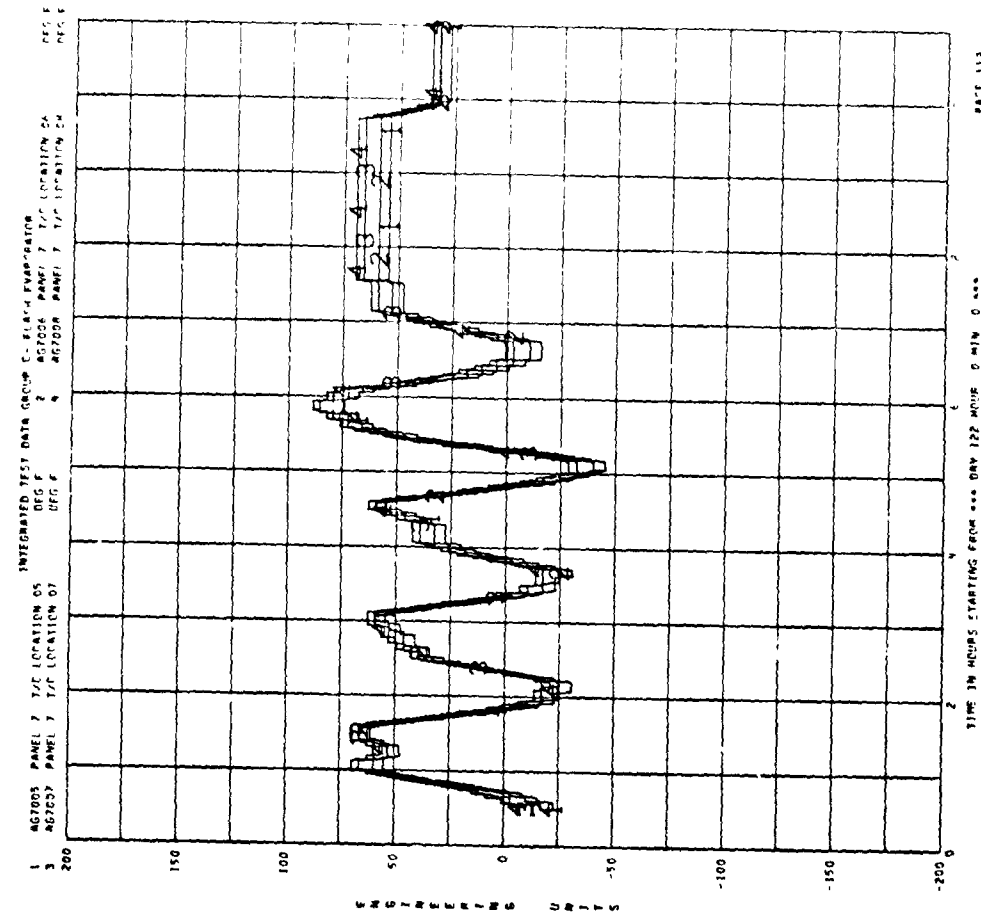
C-115



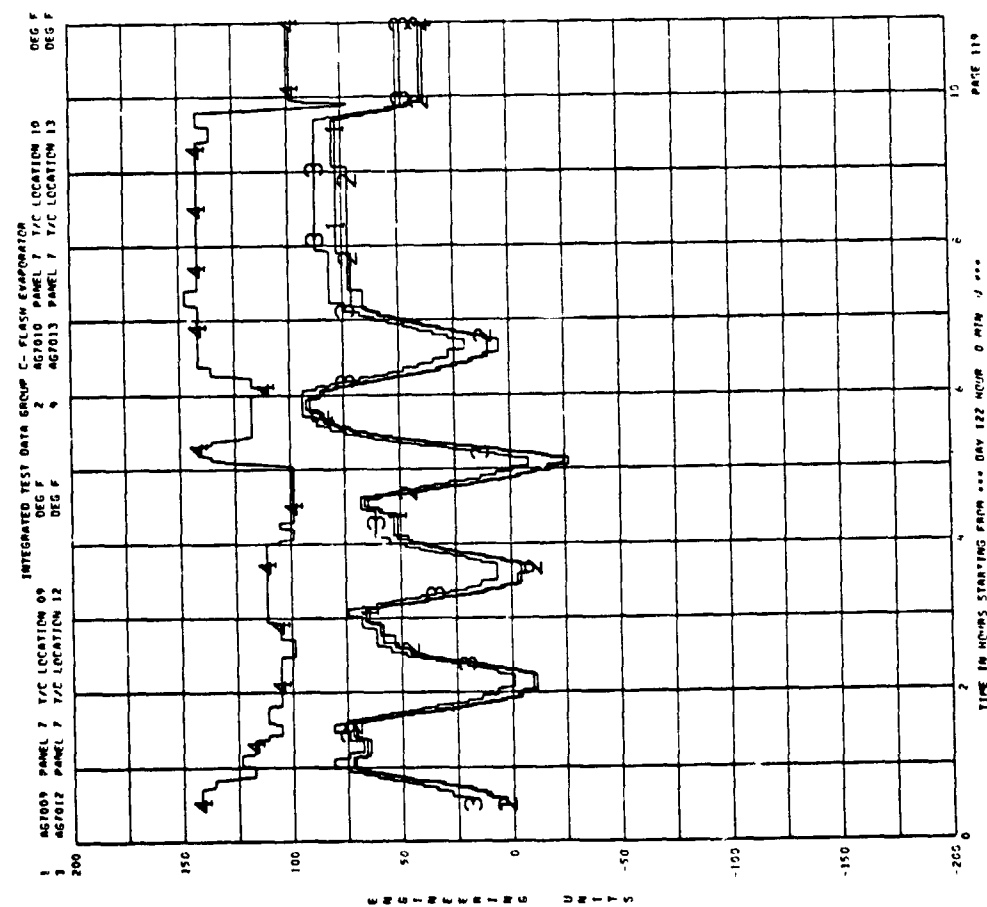
C-116



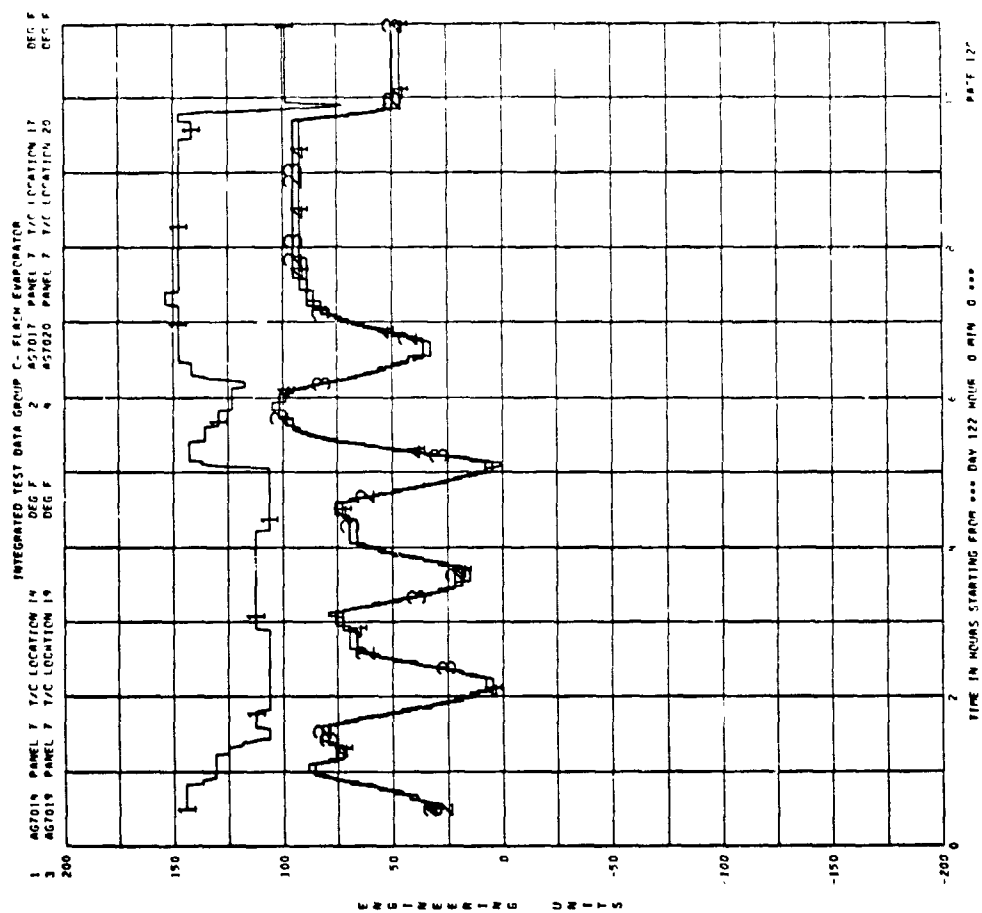
C-117



C-118

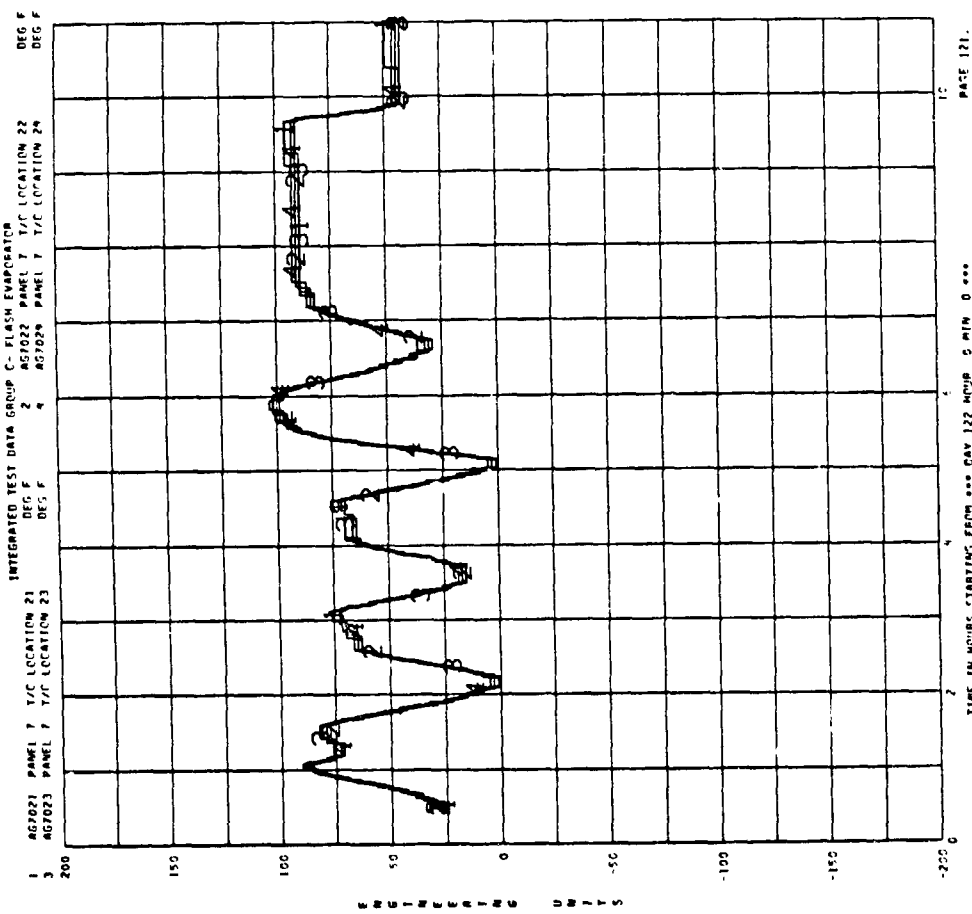


C-119

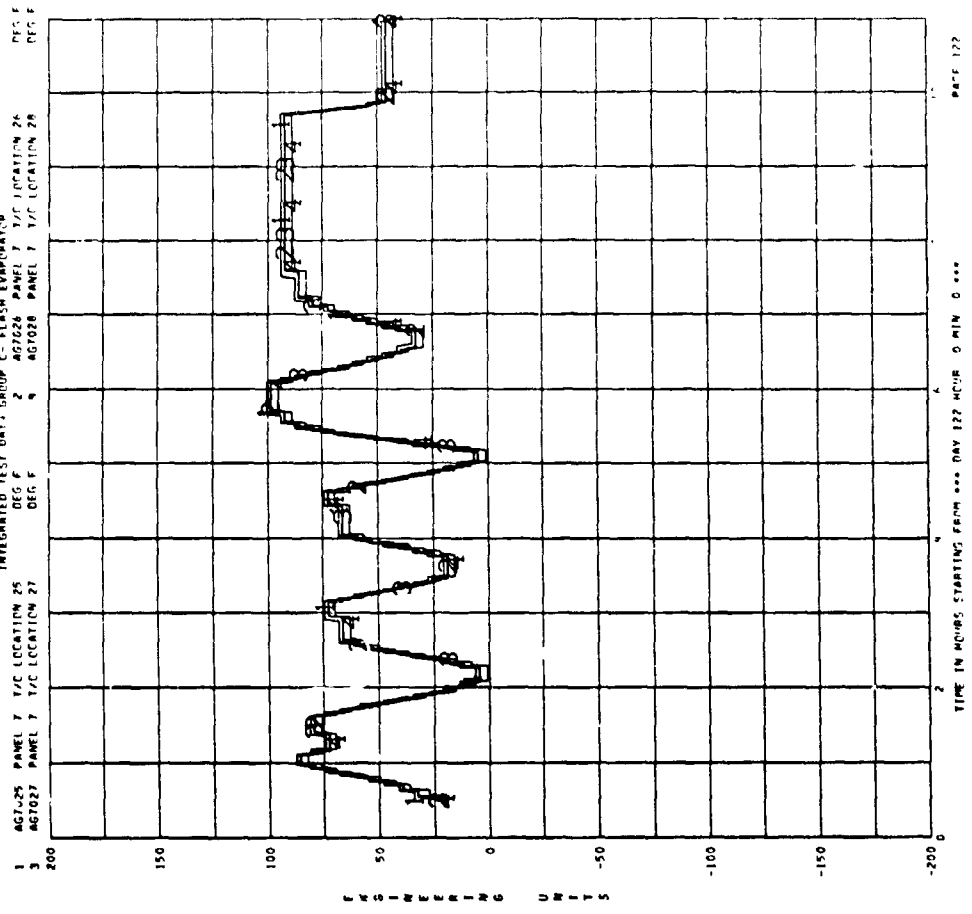


C-120

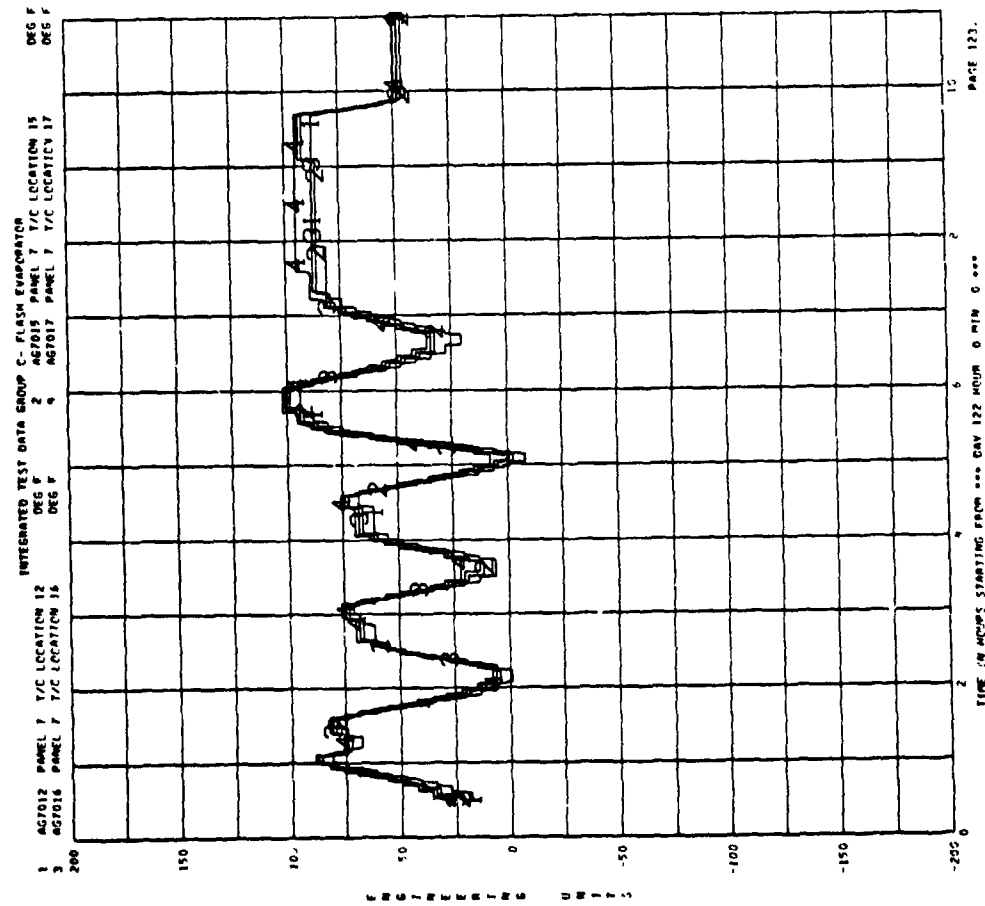
III



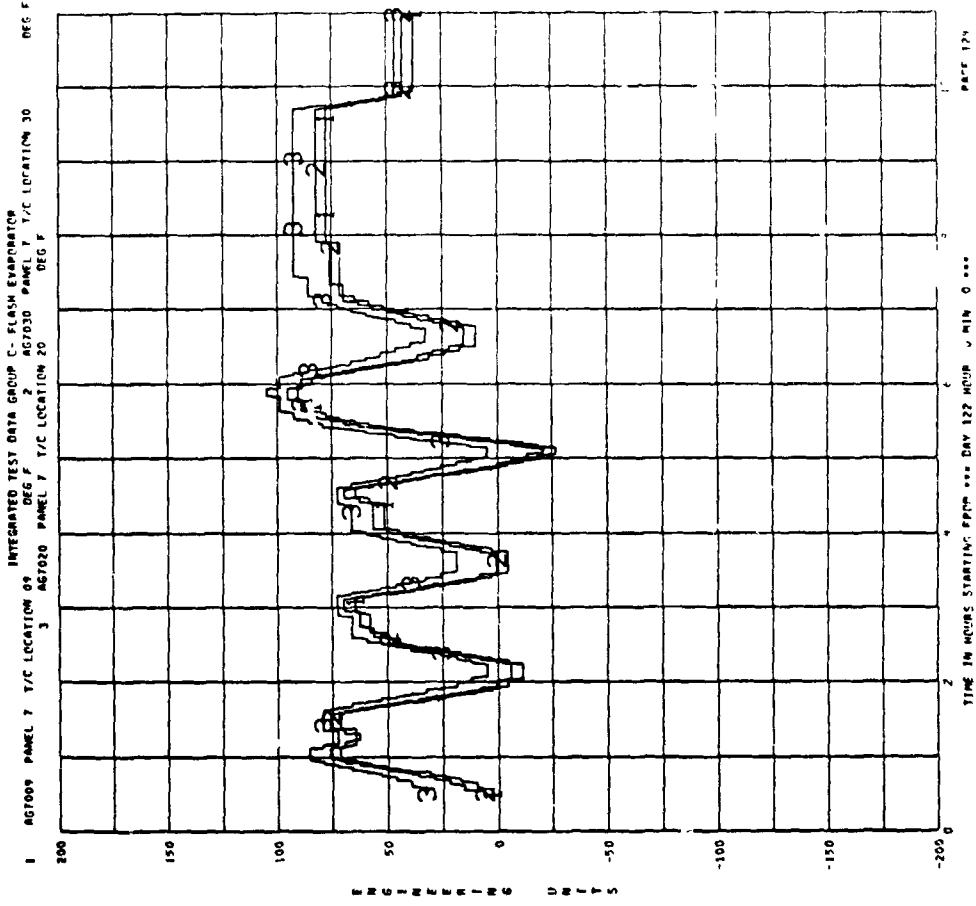
C-121



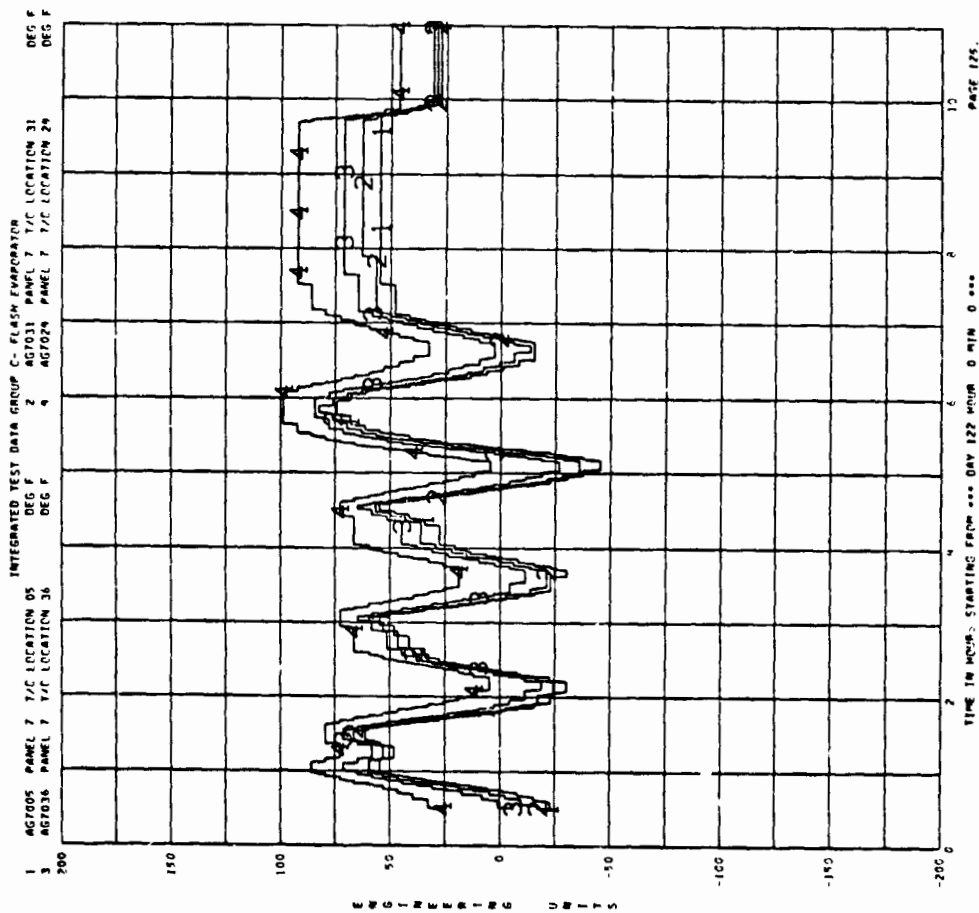
C-122



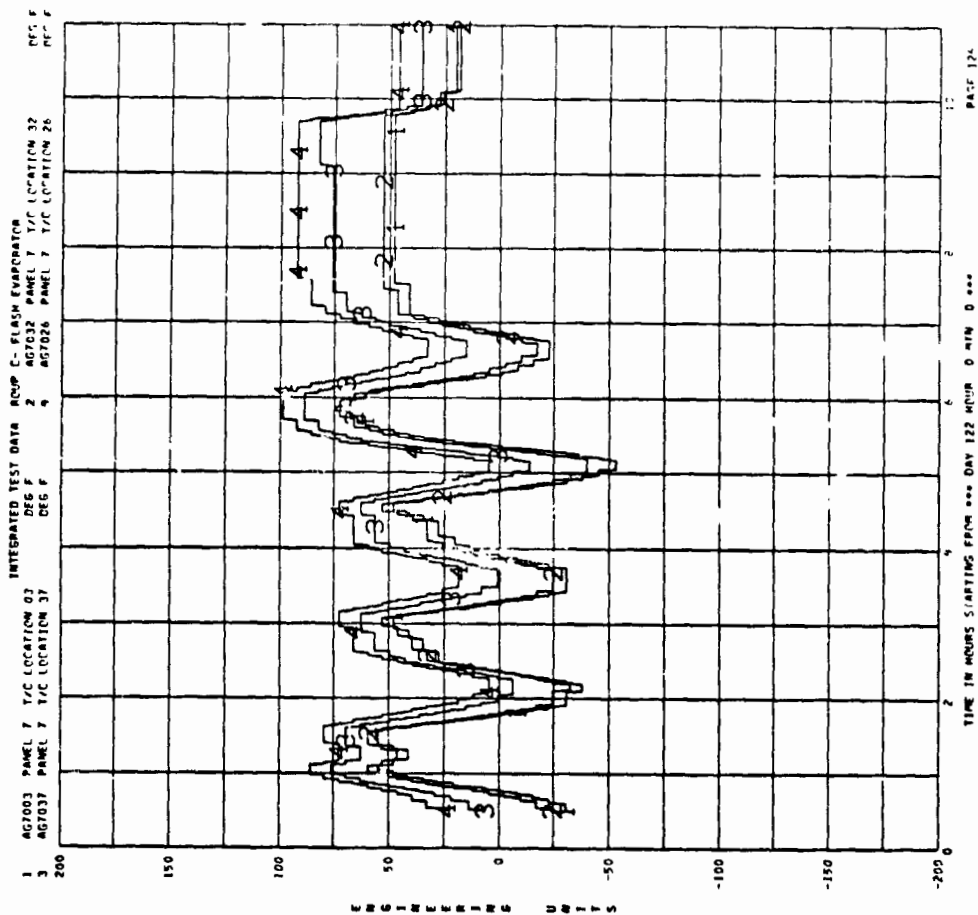
C-123



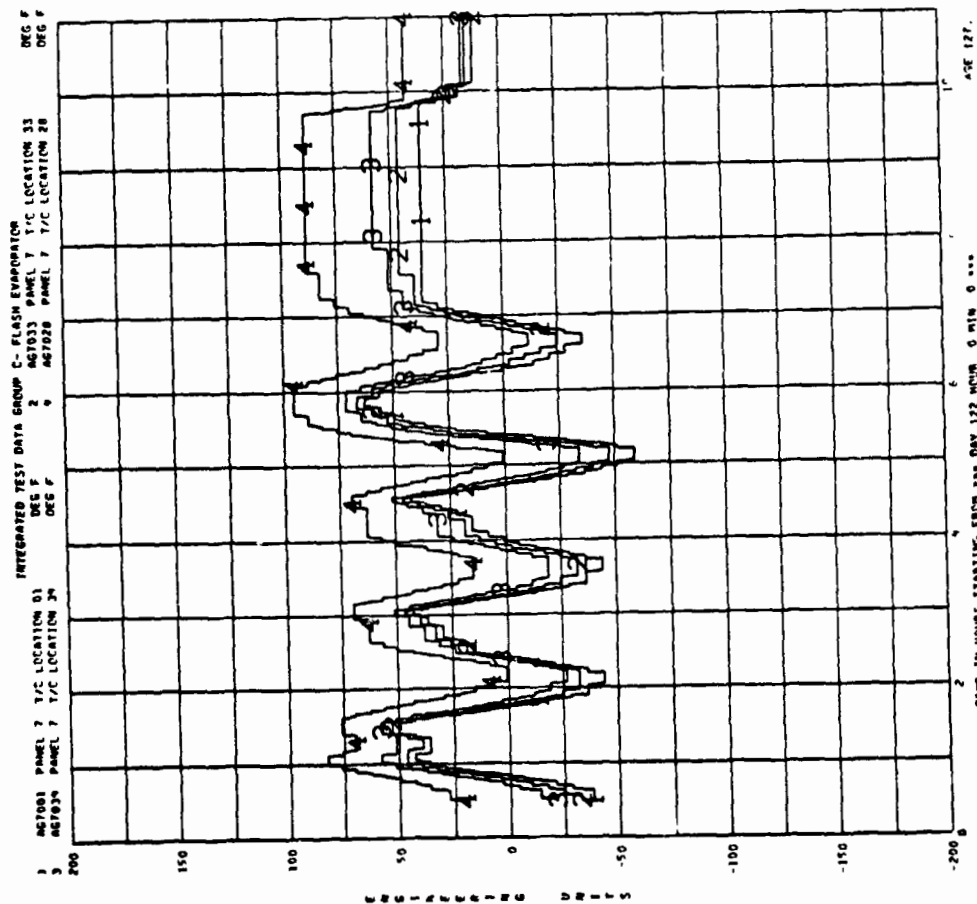
C-124



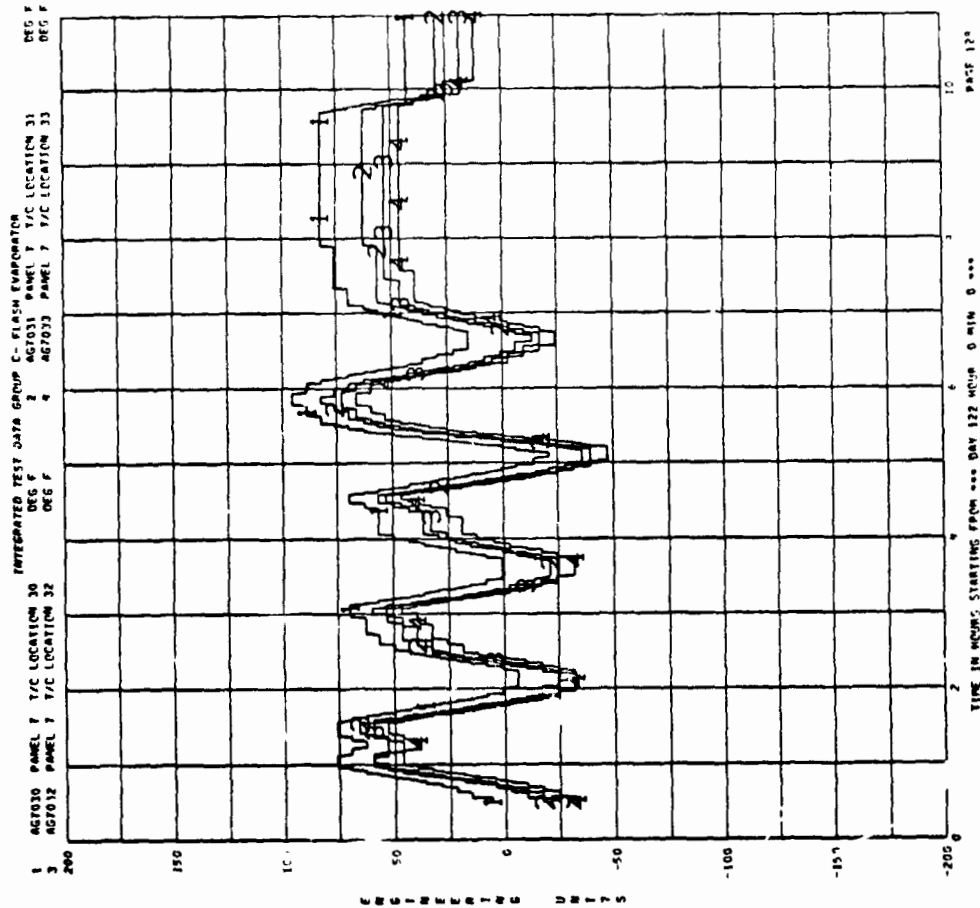
C-125



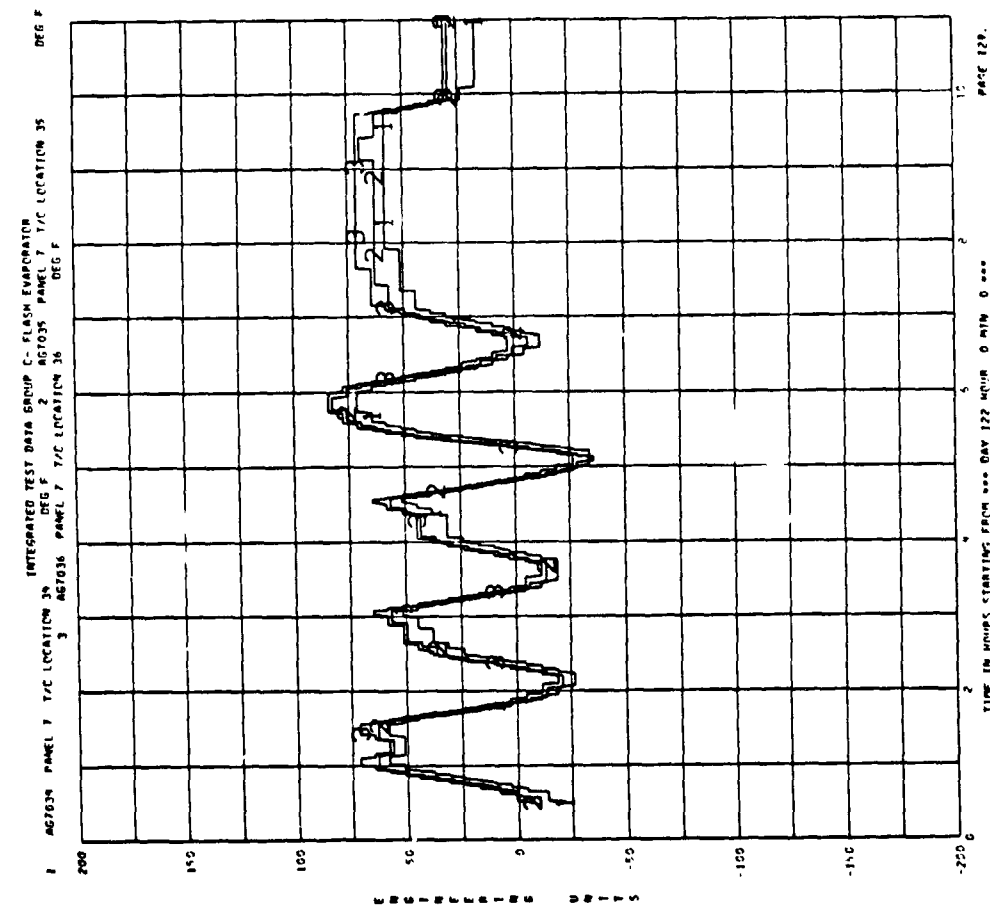
C-126



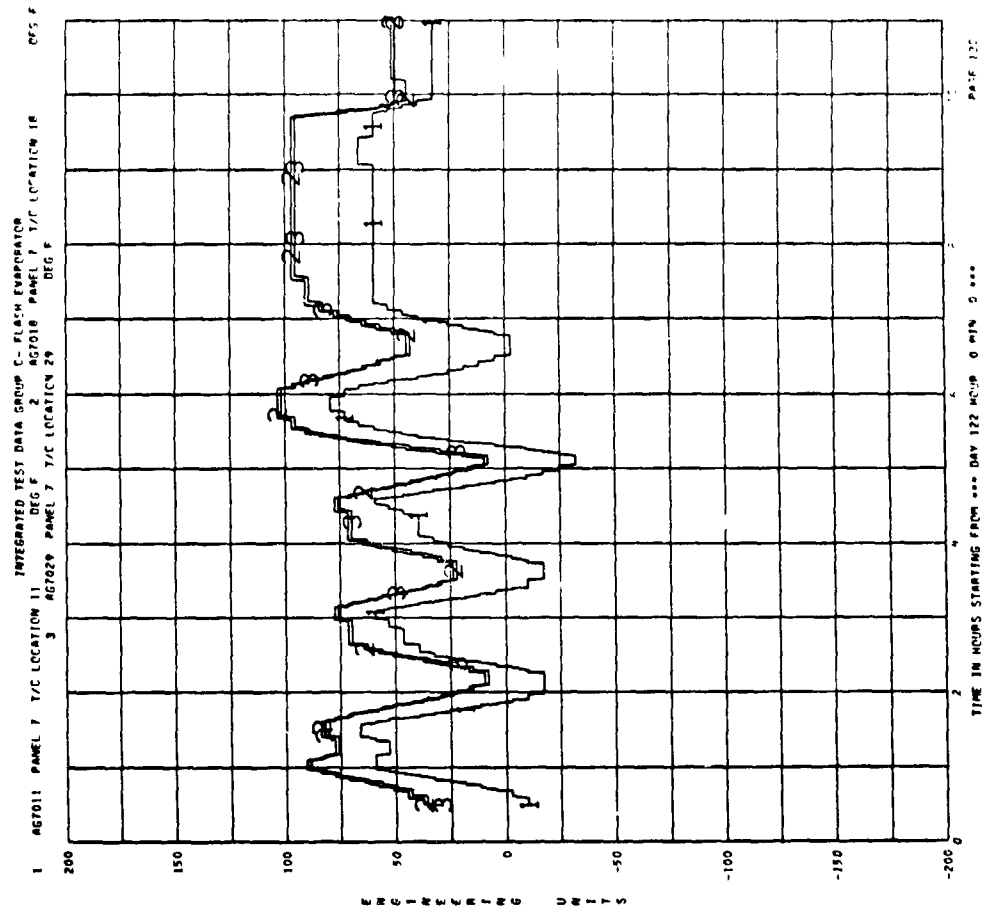
C-127



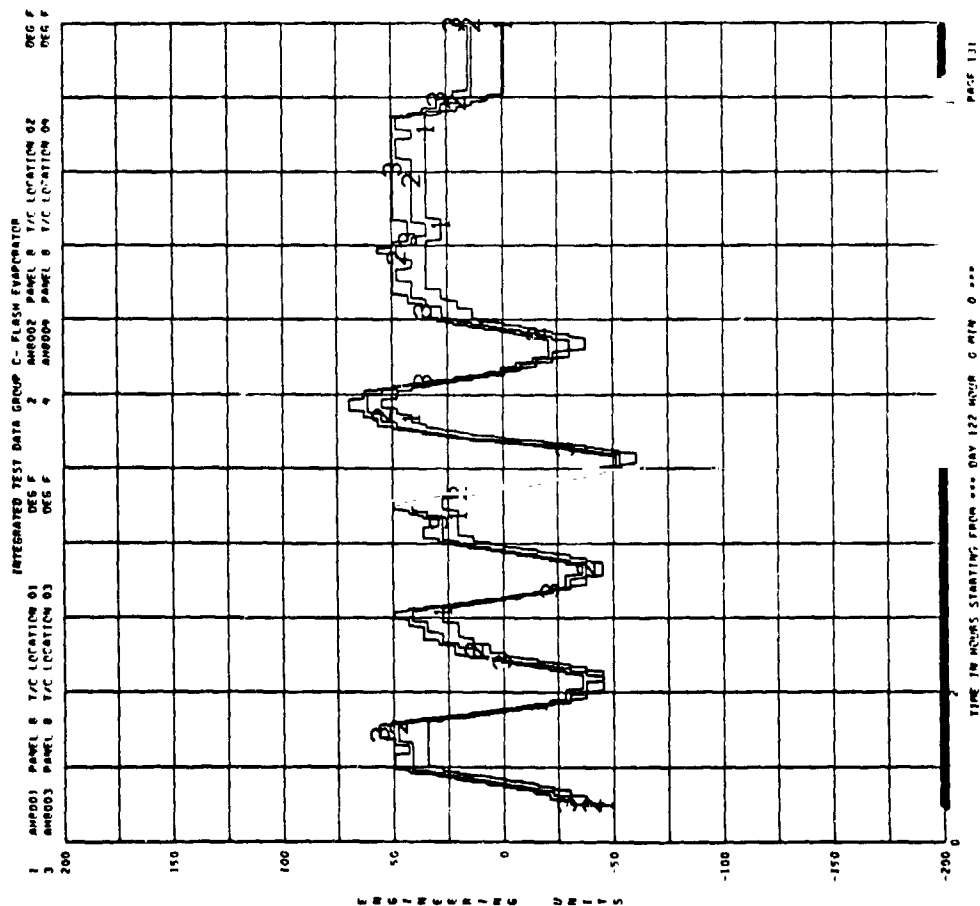
C-128



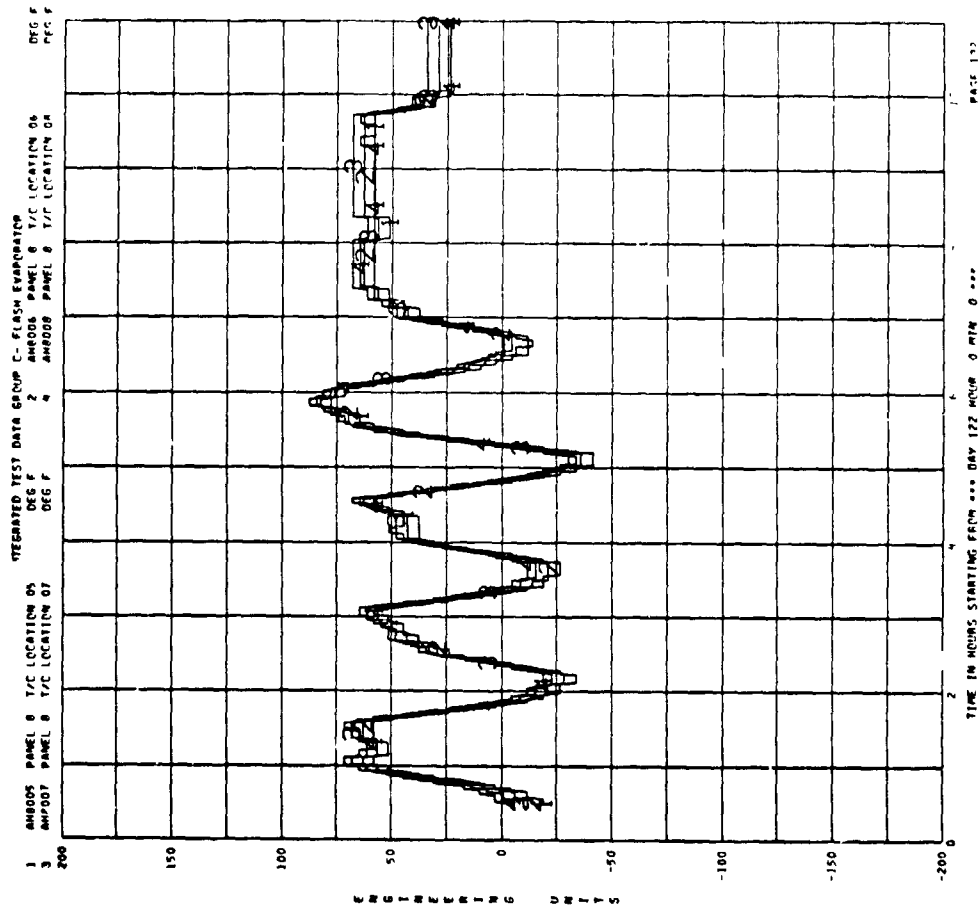
C-129



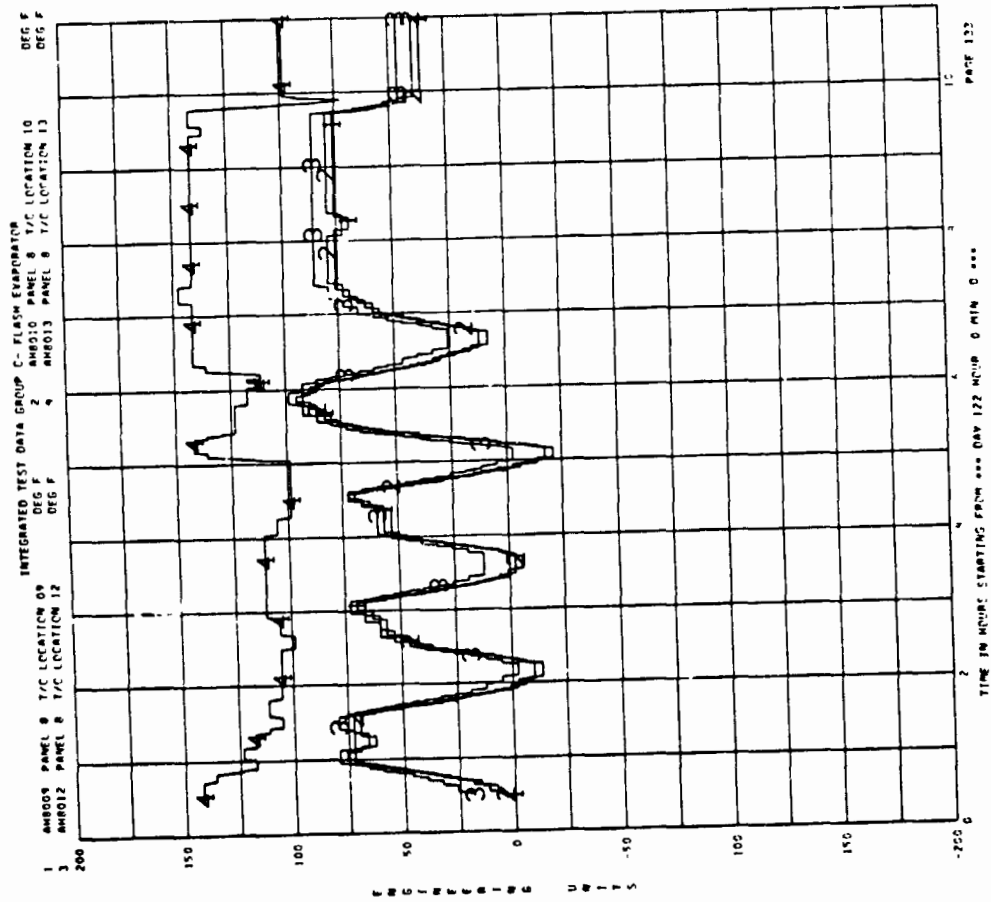
C-130



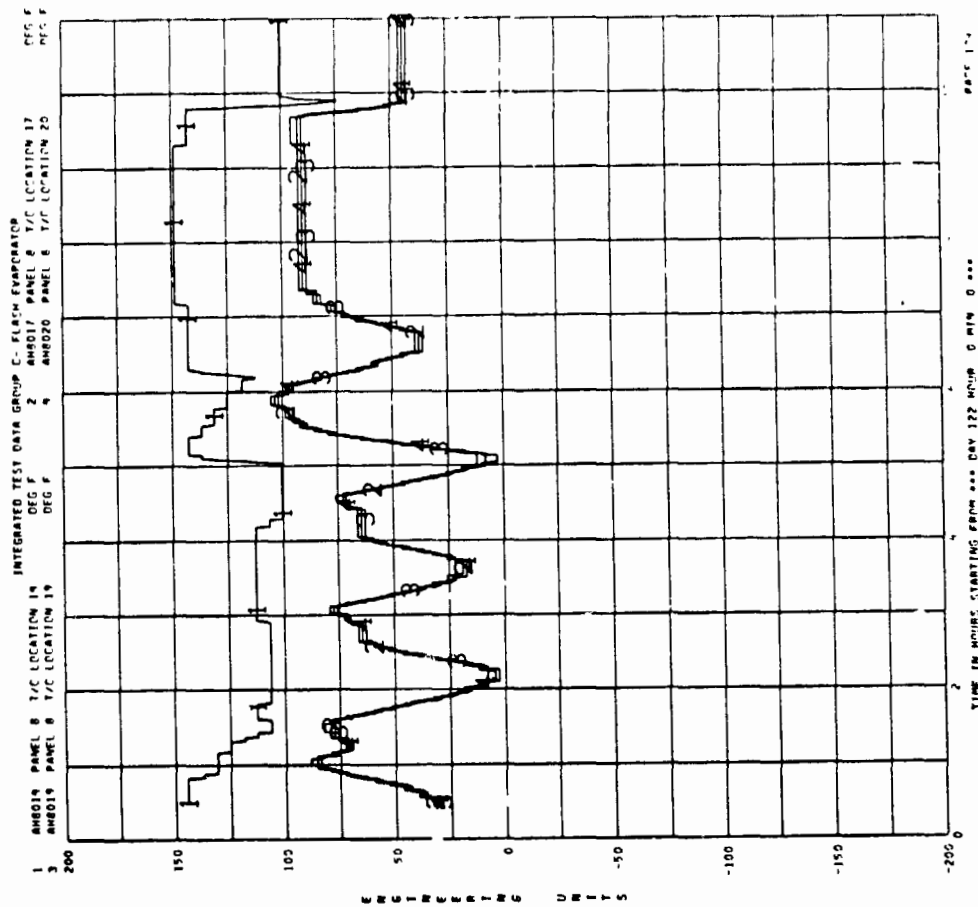
C-131



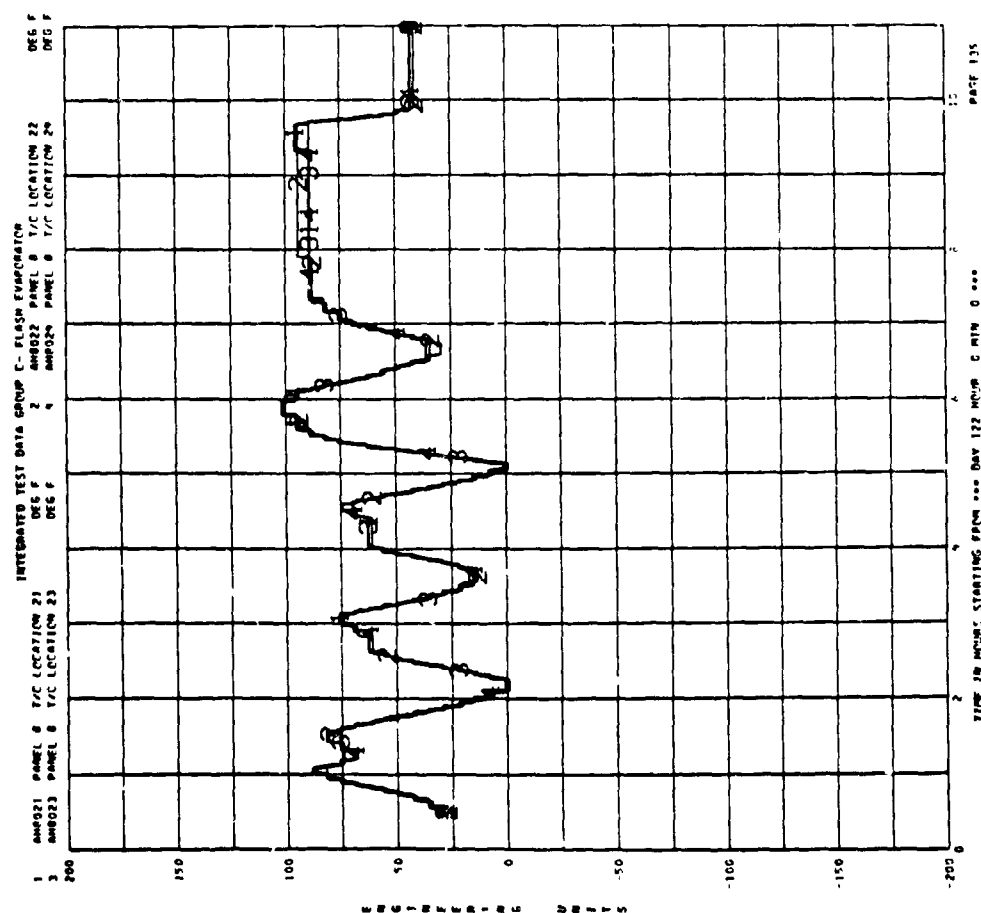
C-132



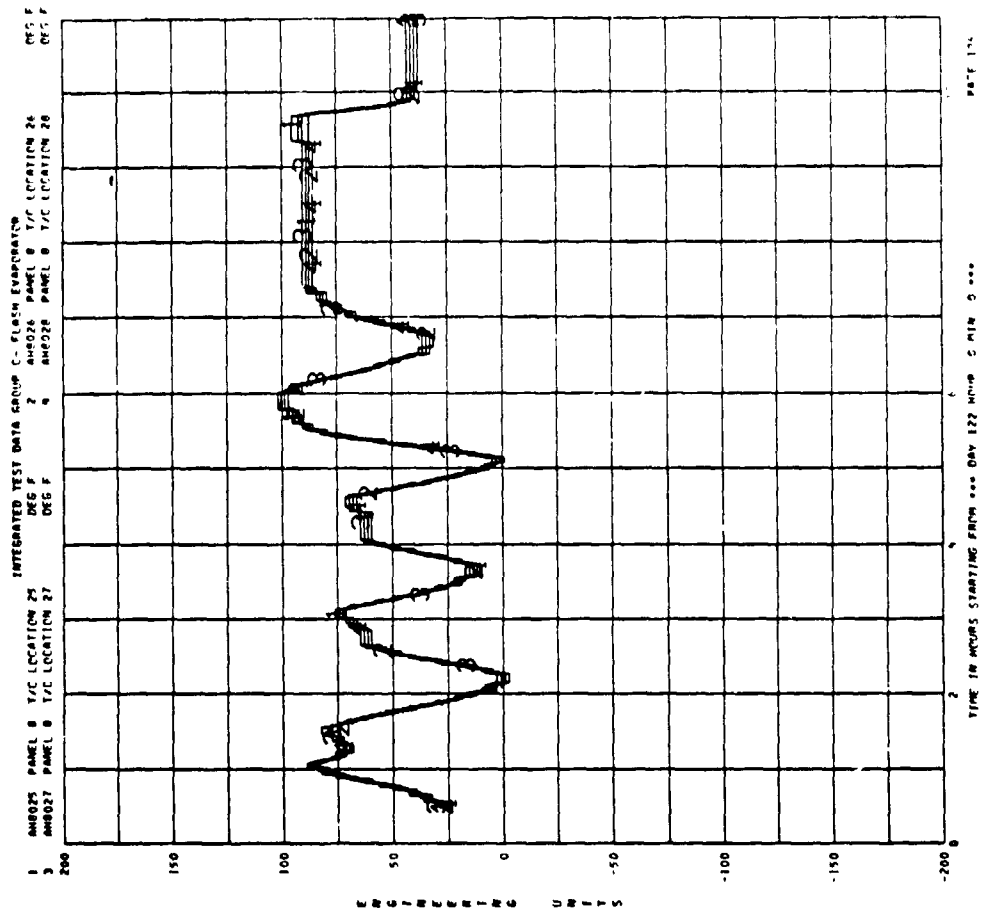
C-133



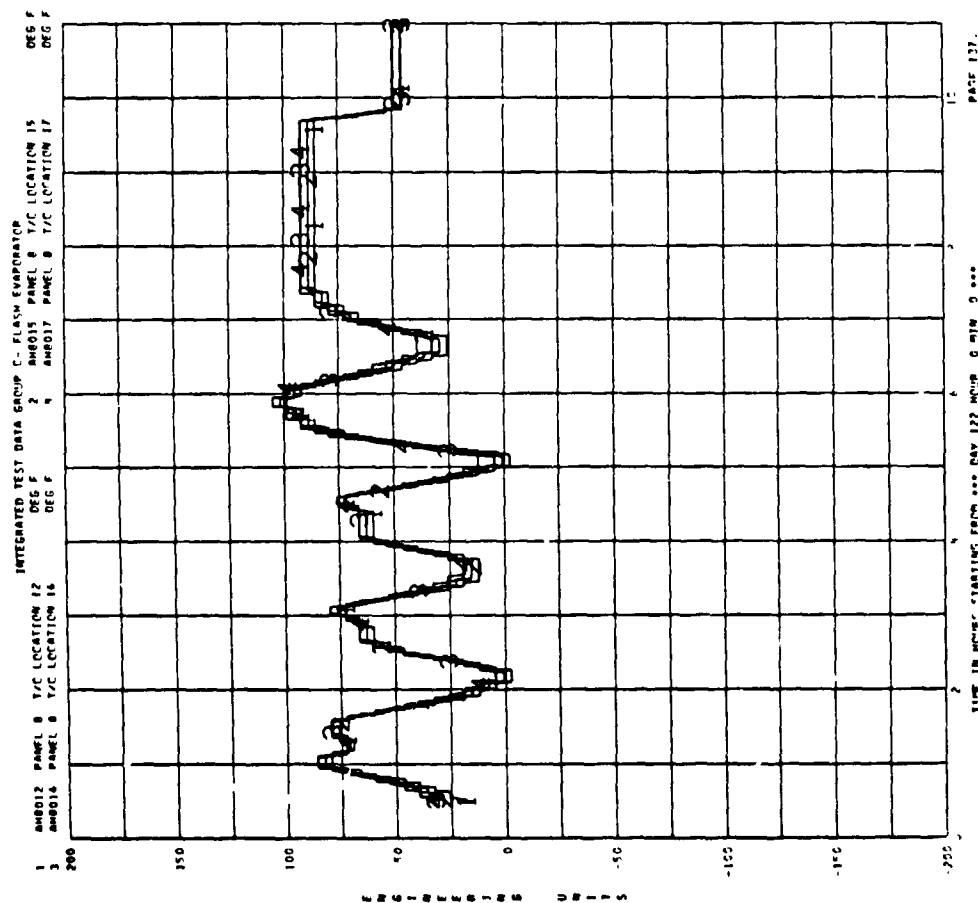
C-134



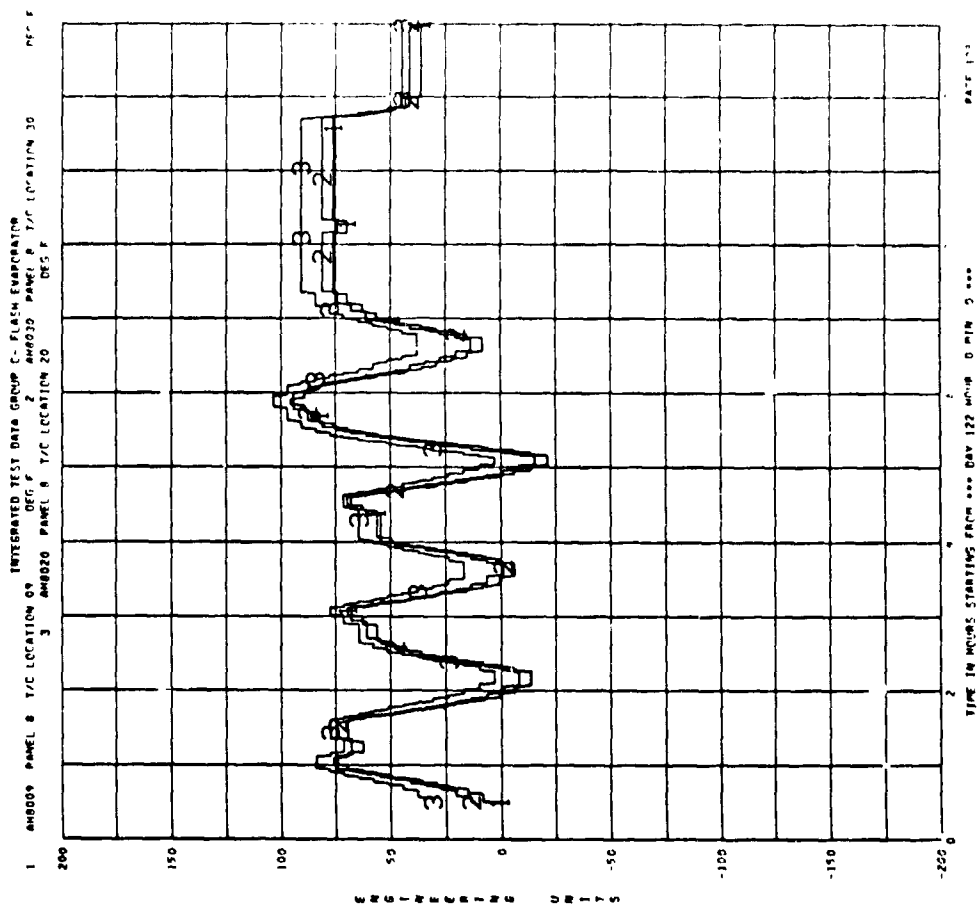
C-135



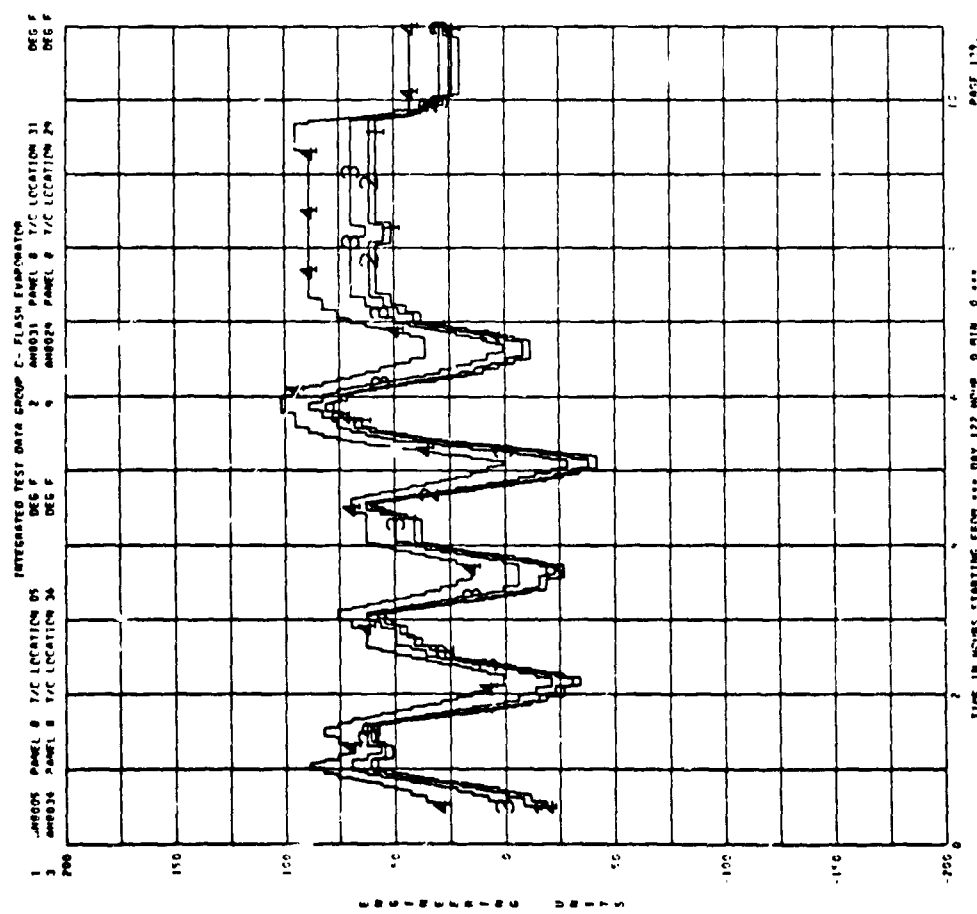
C-136



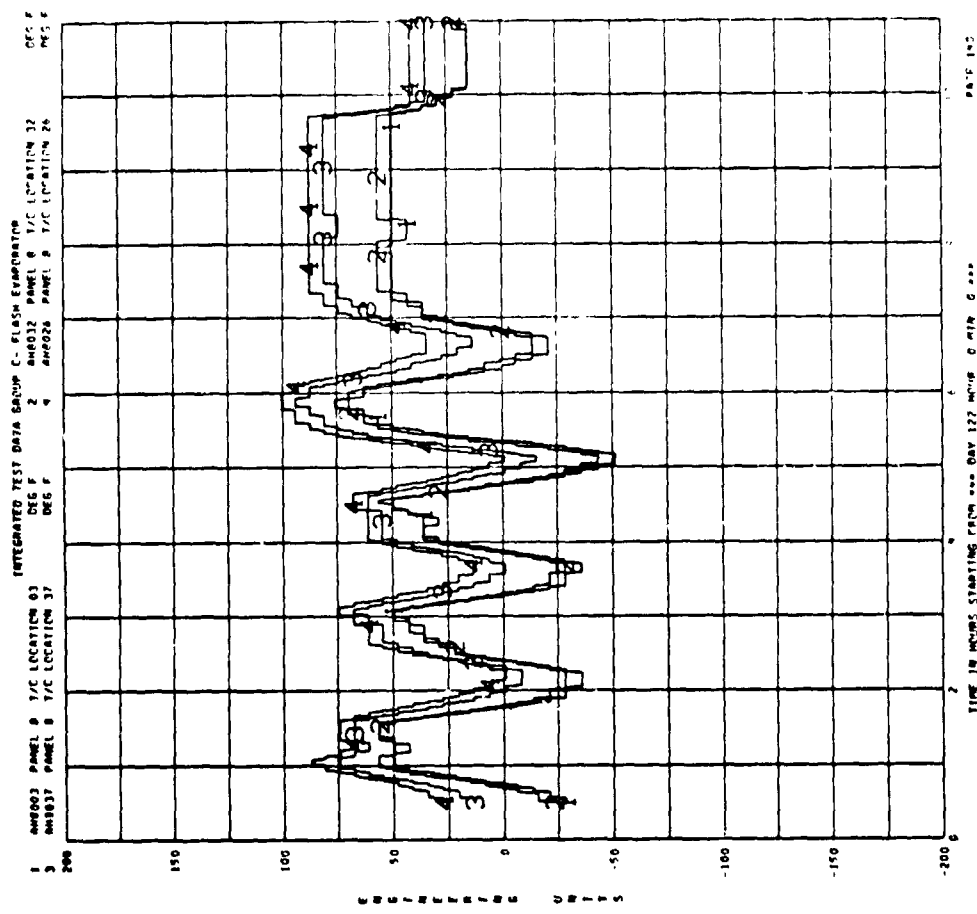
C-137



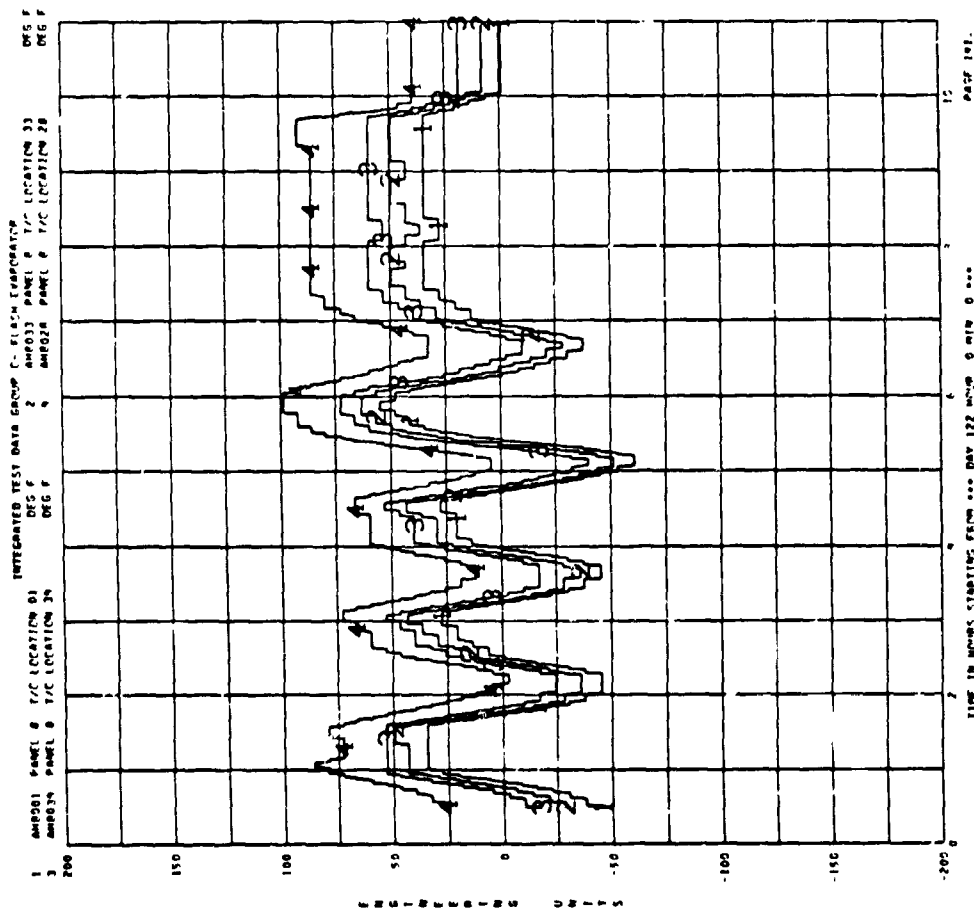
C-138



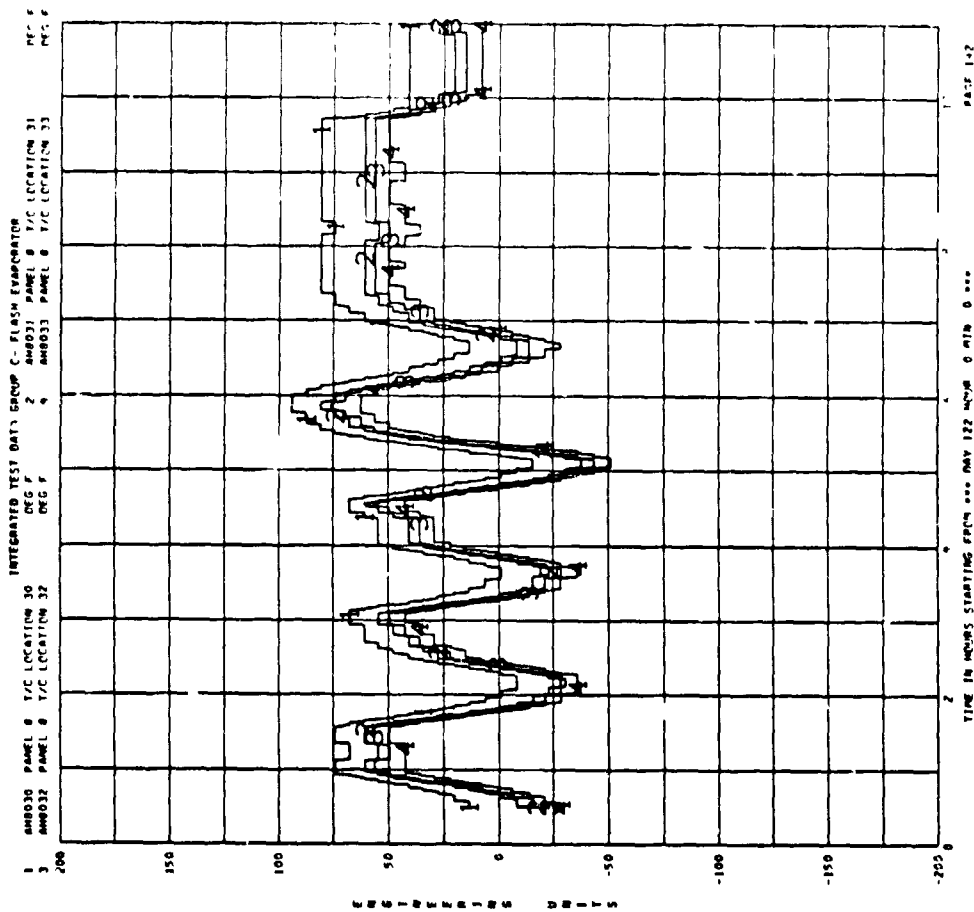
C-139



C-140



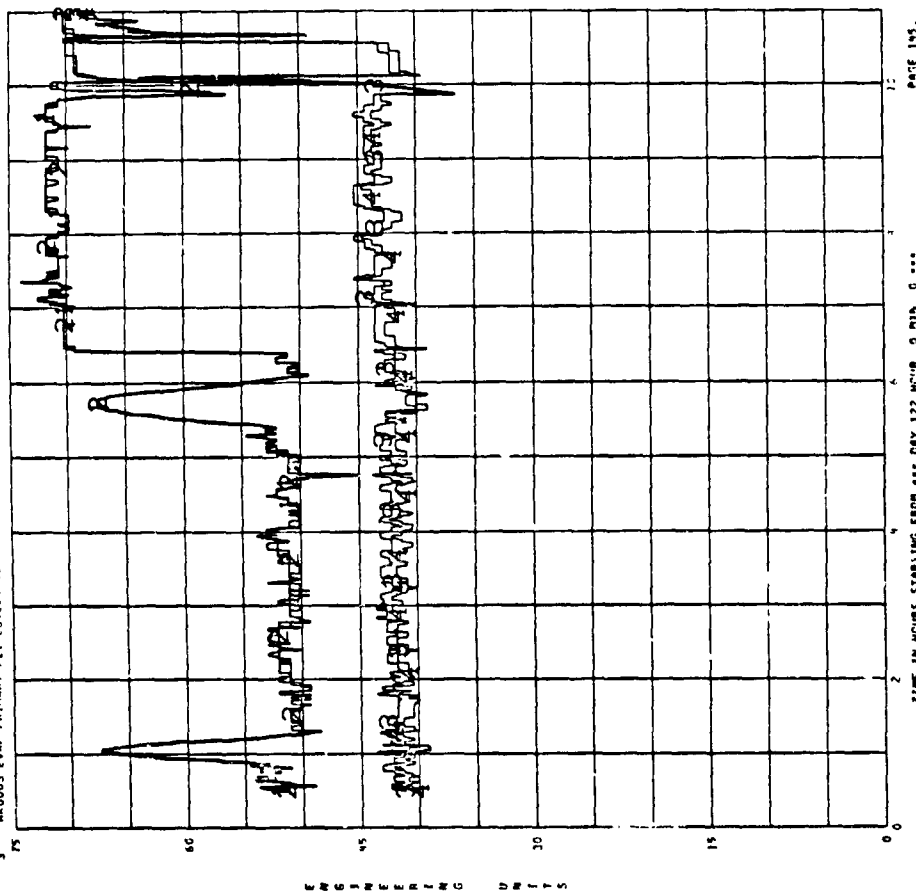
C-141



C-142

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

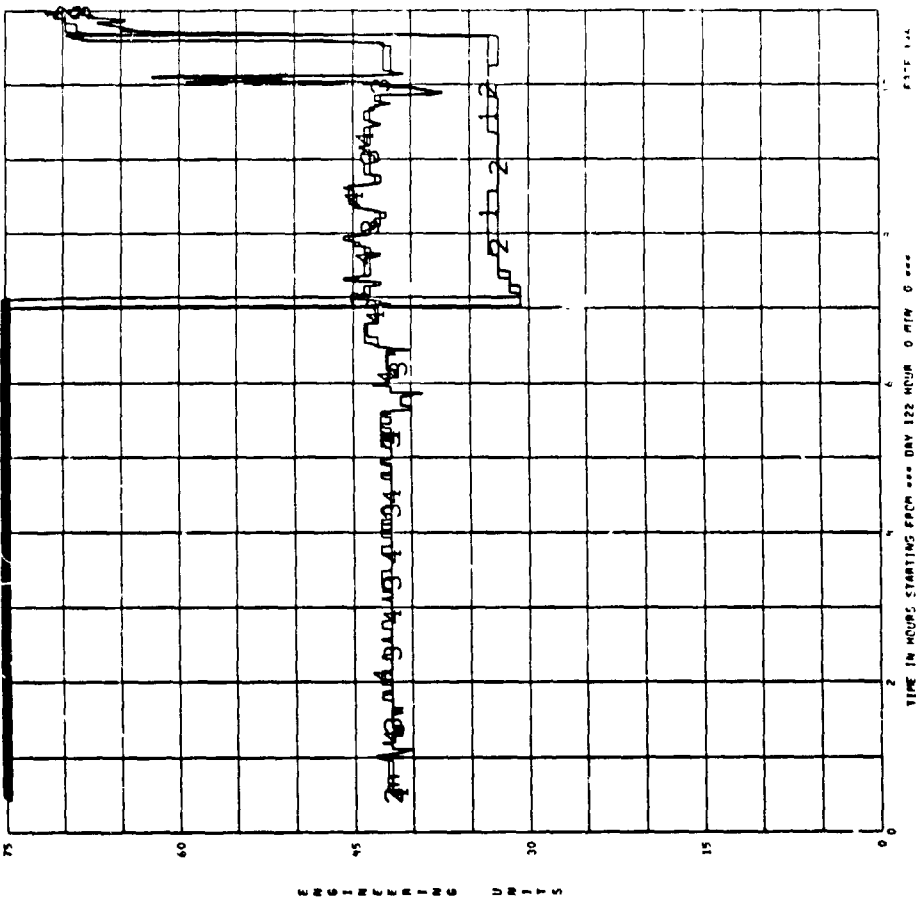
1 AR0001 EVAP PRIMARY F21 INLET TEMP NO 1 DEG F
 2 AR0002 EVAP PRIMARY F21 INLET TEMP NO 2 DEG F
 3 AR0003 EVAP PRIMARY F21 OUTLET TEMP NO 1 DEG F
 4 AR0004 EVAP PRIMARY F21 OUTLET TEMP NO 2 DEG F



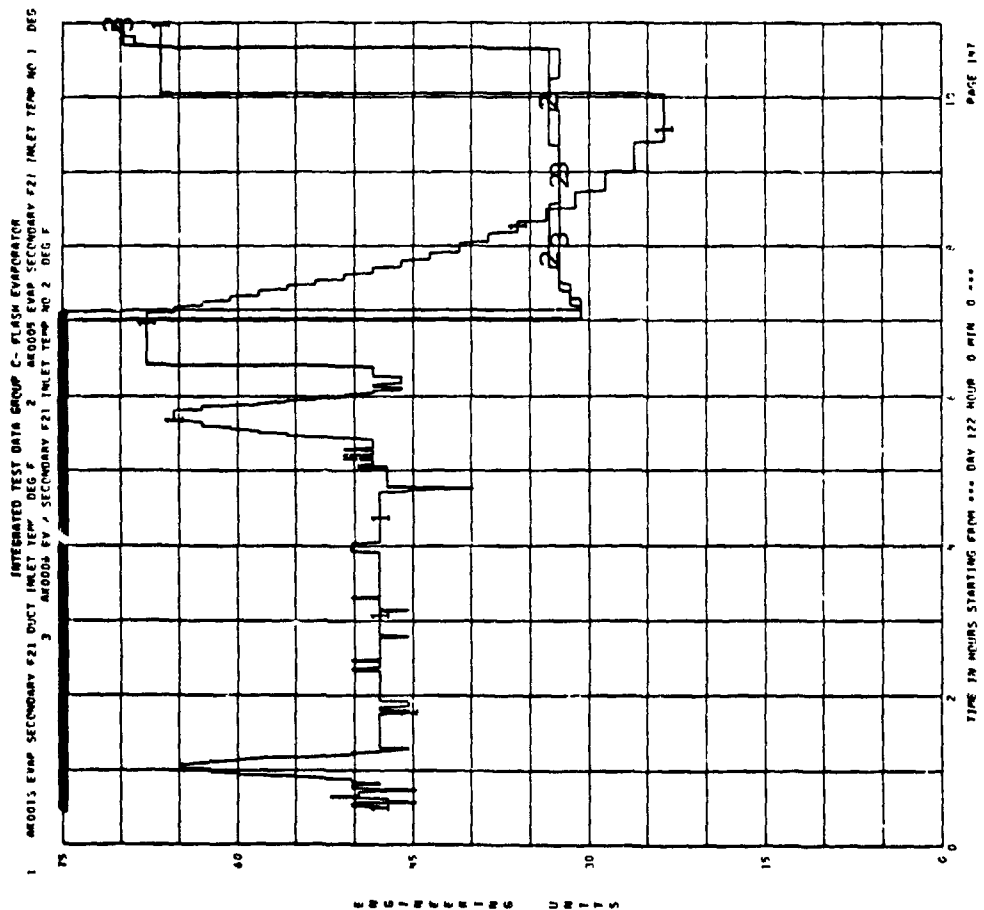
C-145

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR

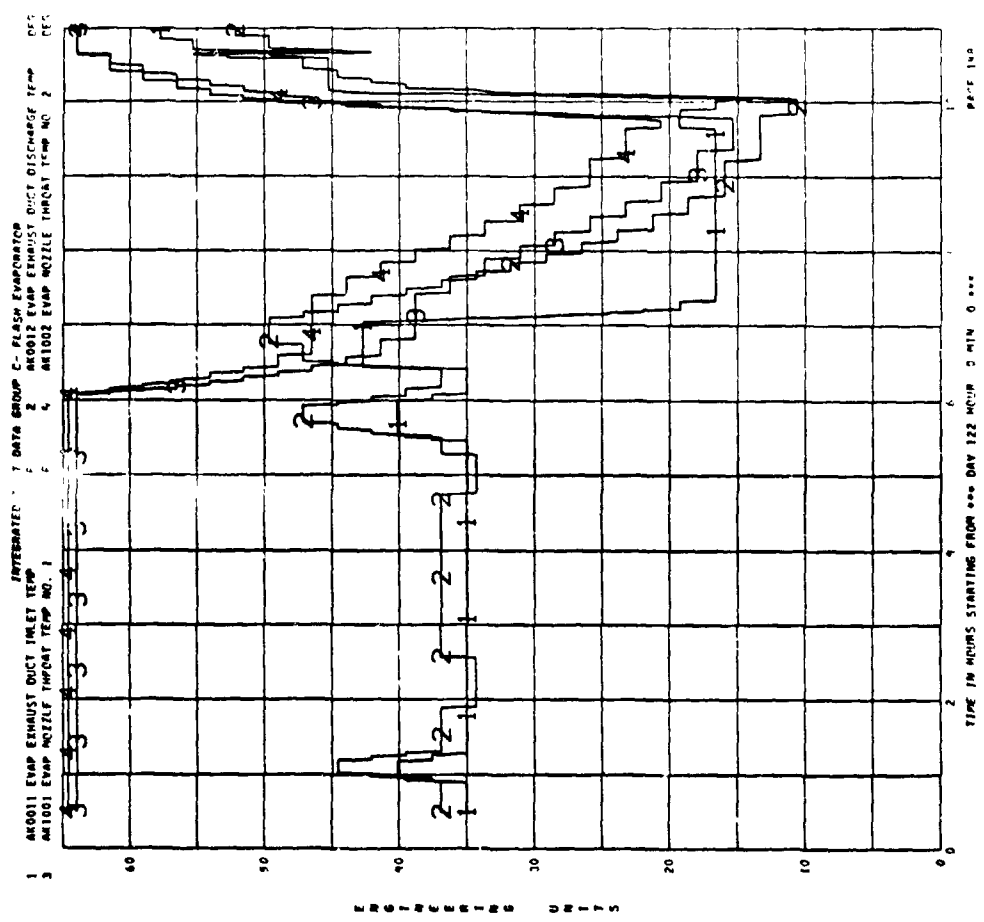
1 AR0005 EVAP SECONDARY F21 INLET TEMP NO 1 DEG F
 2 AR0006 EVAP SECONDARY F21 INLET TEMP NO 2 DEG F
 3 AR0007 EVAP SECONDARY F21 OUTLET TEMP NO 1 DEG F
 4 AR0008 EVAP SECONDARY F21 OUTLET TEMP NO 2 DEG F



C-146

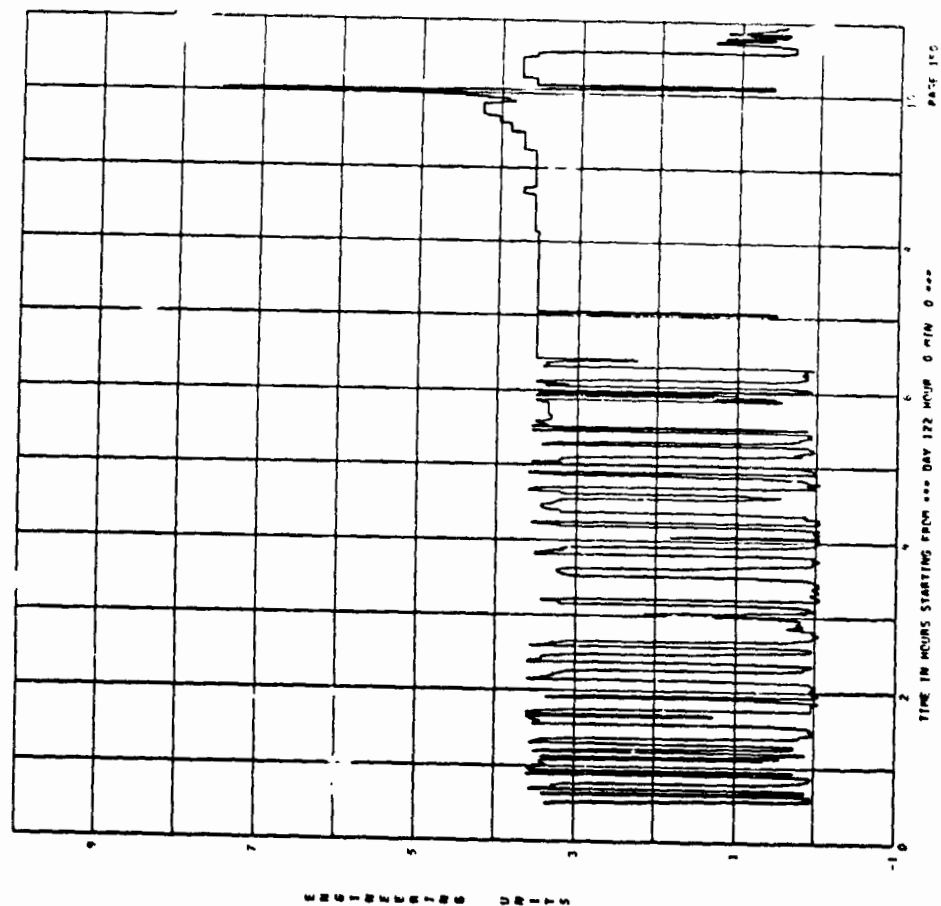


C-147

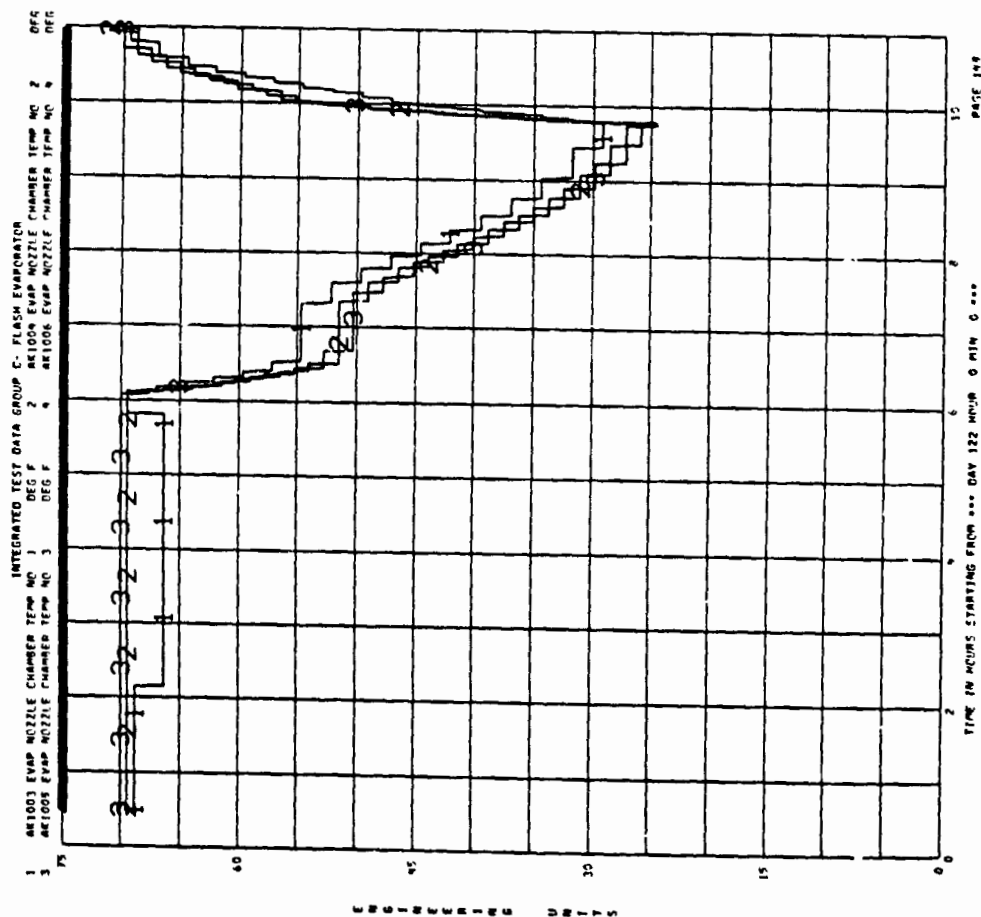


C-148

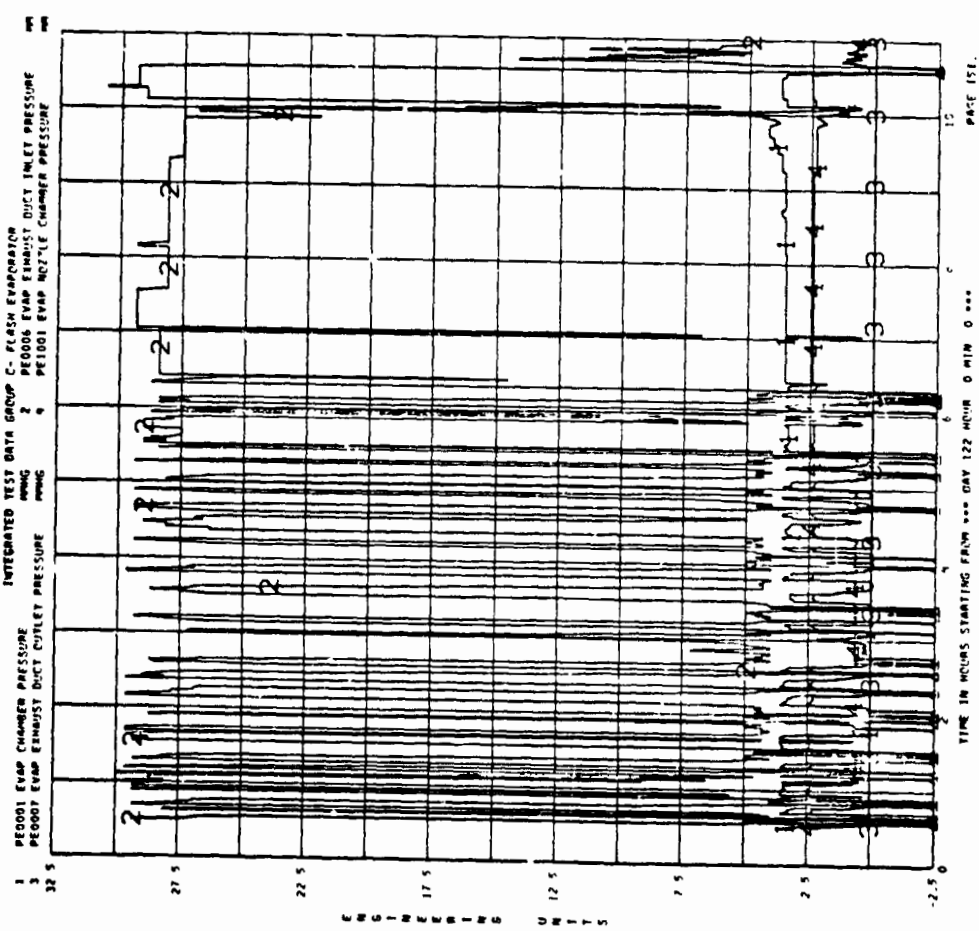
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|



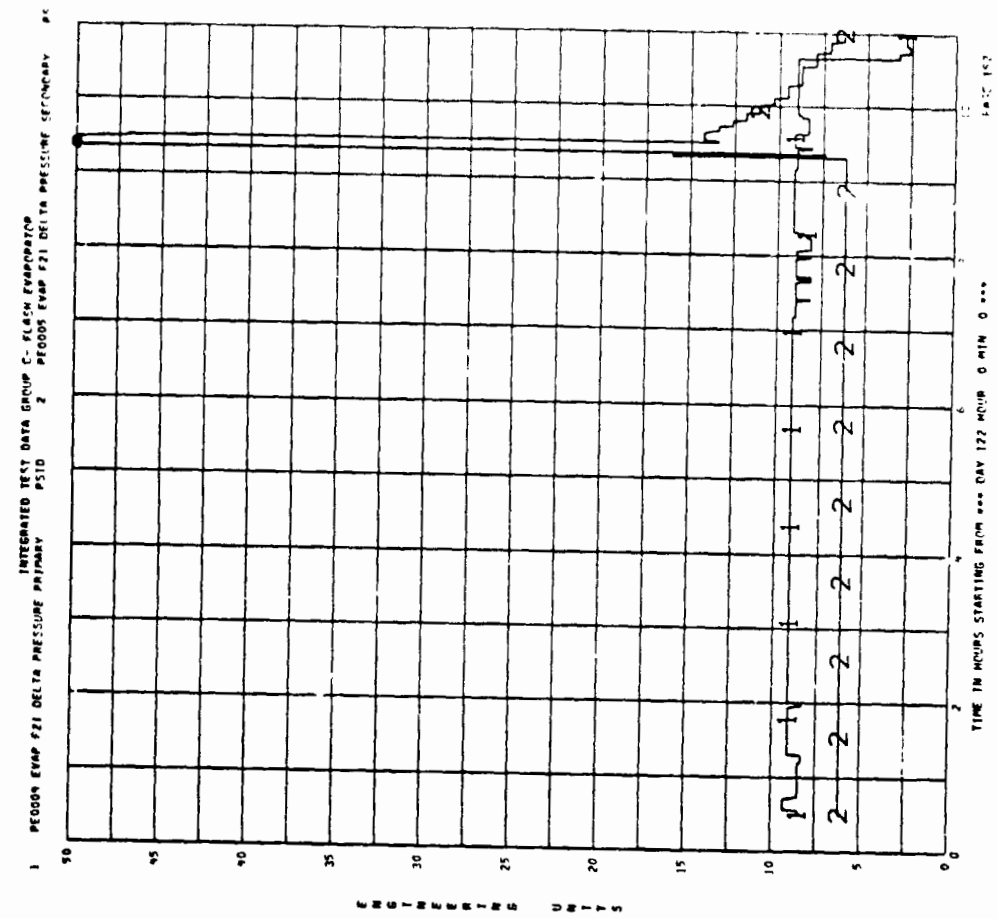
C-150



C-149

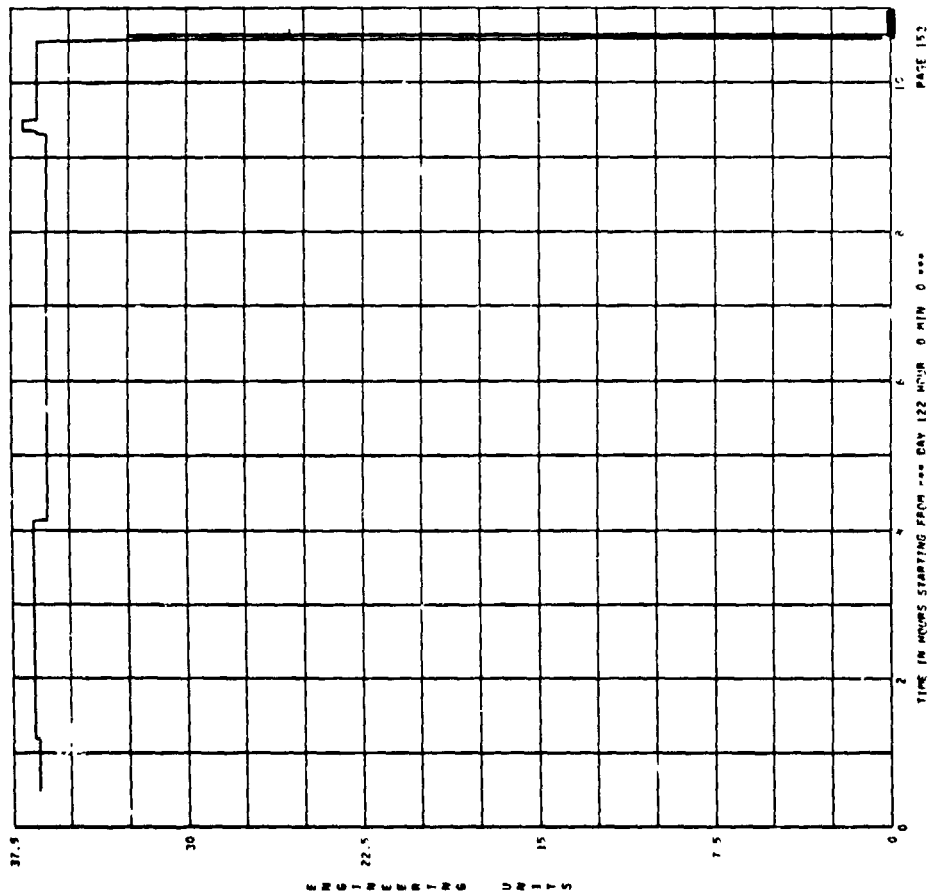


C-151



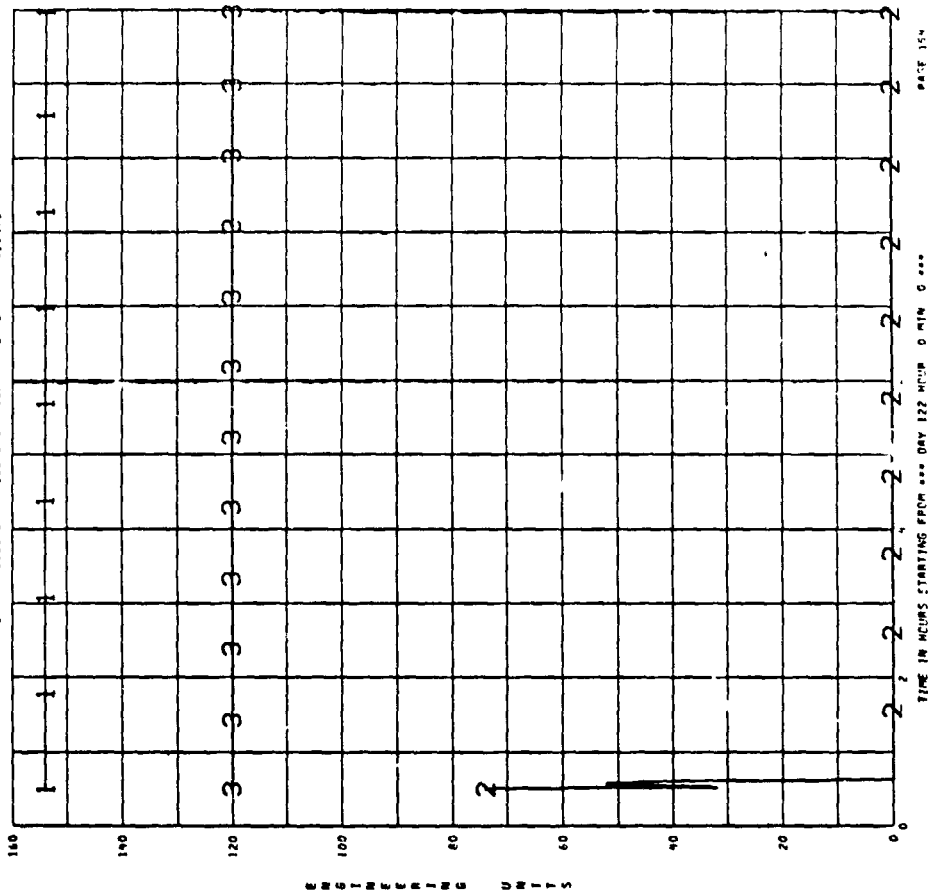
C-152

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
PSIA



C-153

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
COUNTS

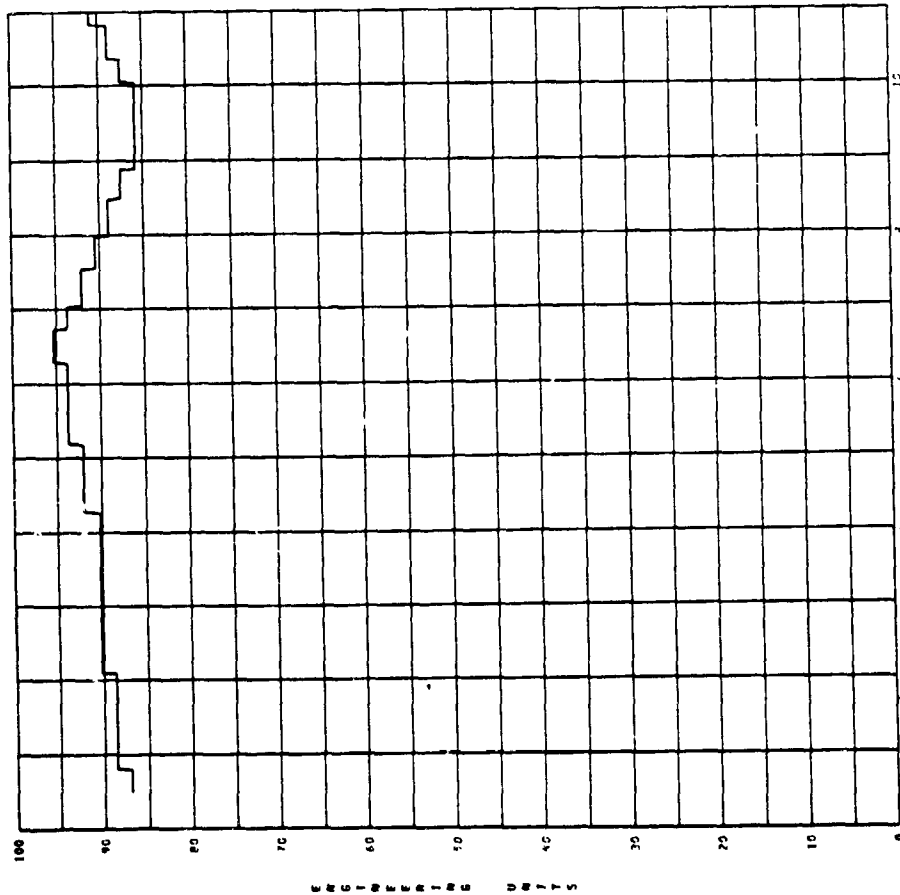


C-154

INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
LB

1

LE0001 C'VAP H2O TANK QUANTITY



TIME IN HOURS STARTING FROM *** DAY 122 HOUR 0 MIN 0 ***

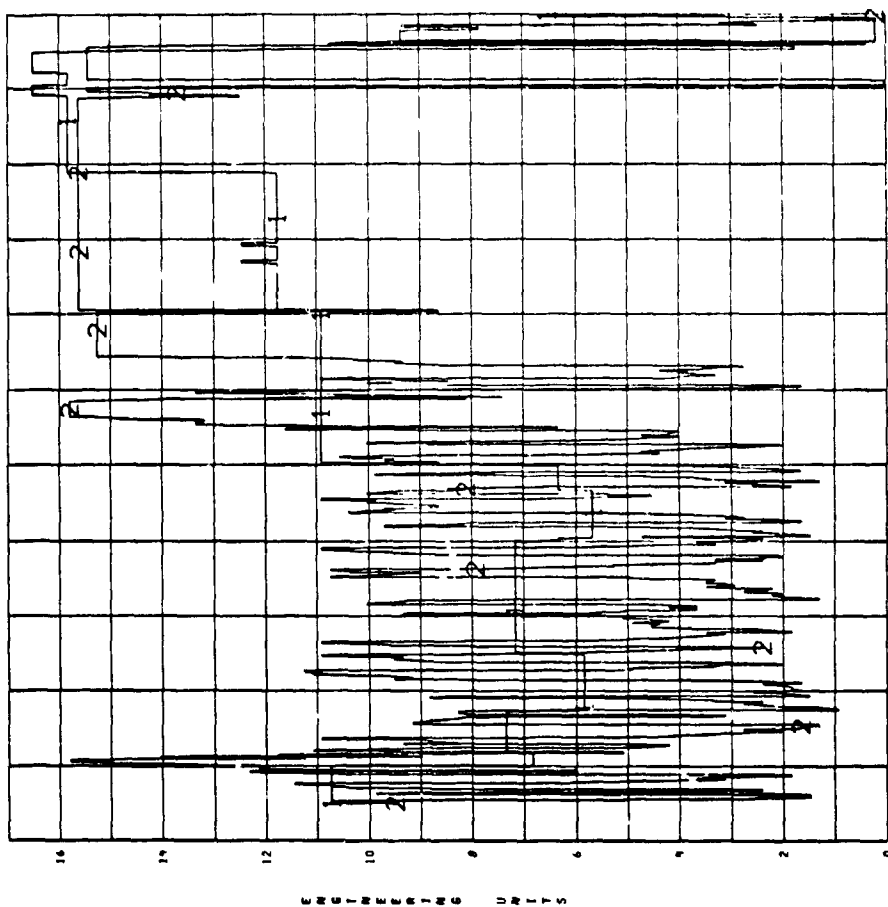
C-155

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INTEGRATED TEST DATA GROUP C- FLASH EVAPORATOR
LBS/HR

1

FM0001 H2O FLOW INTO TANK



TIME IN HOURS STARTING FROM *** DAY 122 HOUR 0 MIN 0 ***

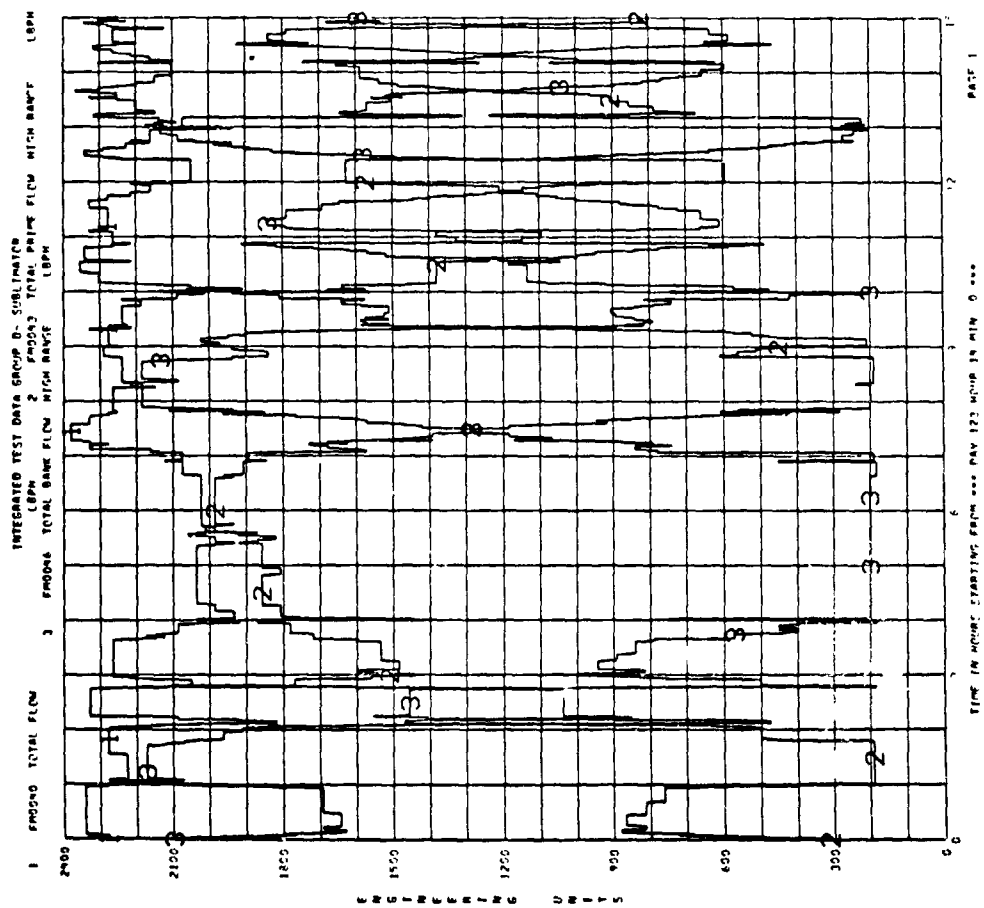
C-156

PAGE 156

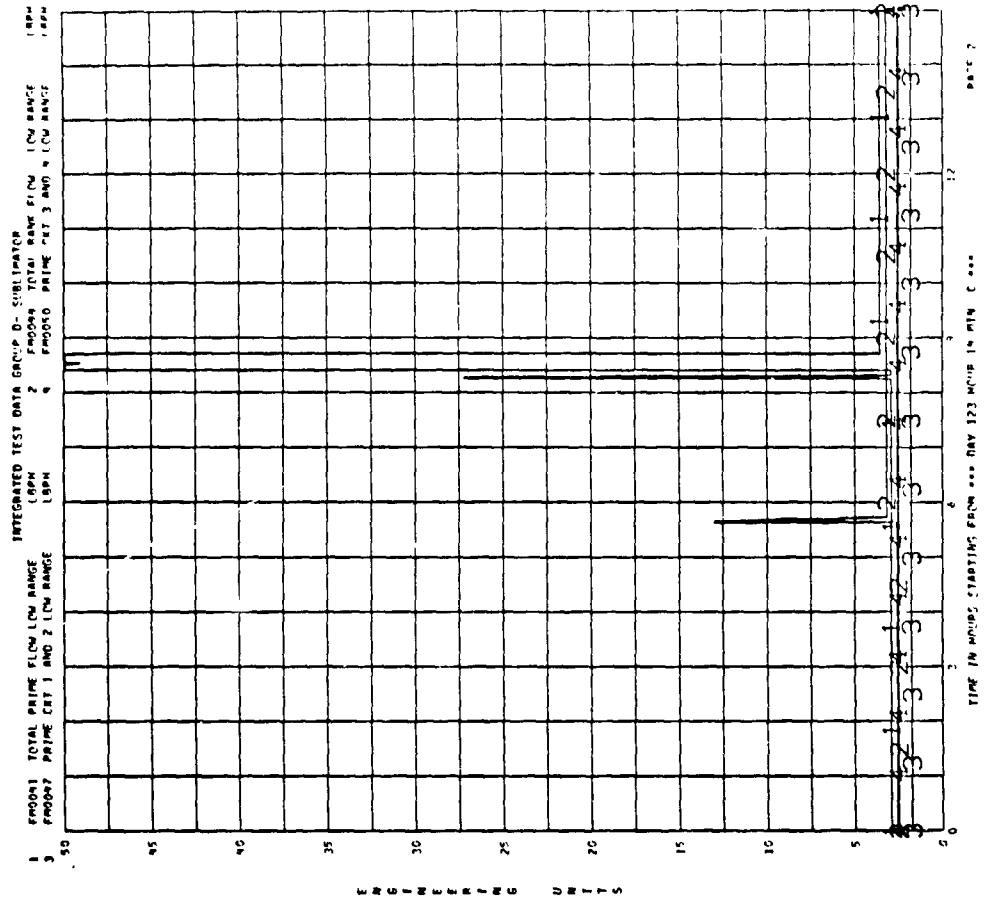
DATA GROUP D

TEST POINTS 24-36

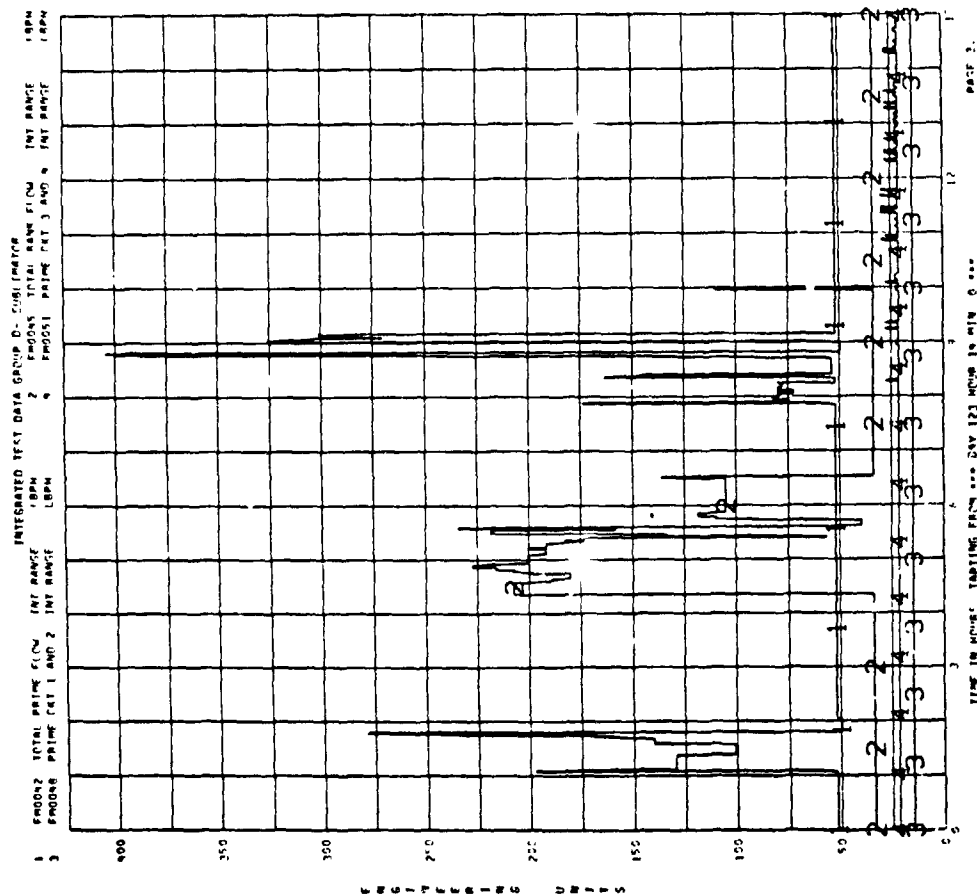
From Day 123, 1400 to Day 124, 0500



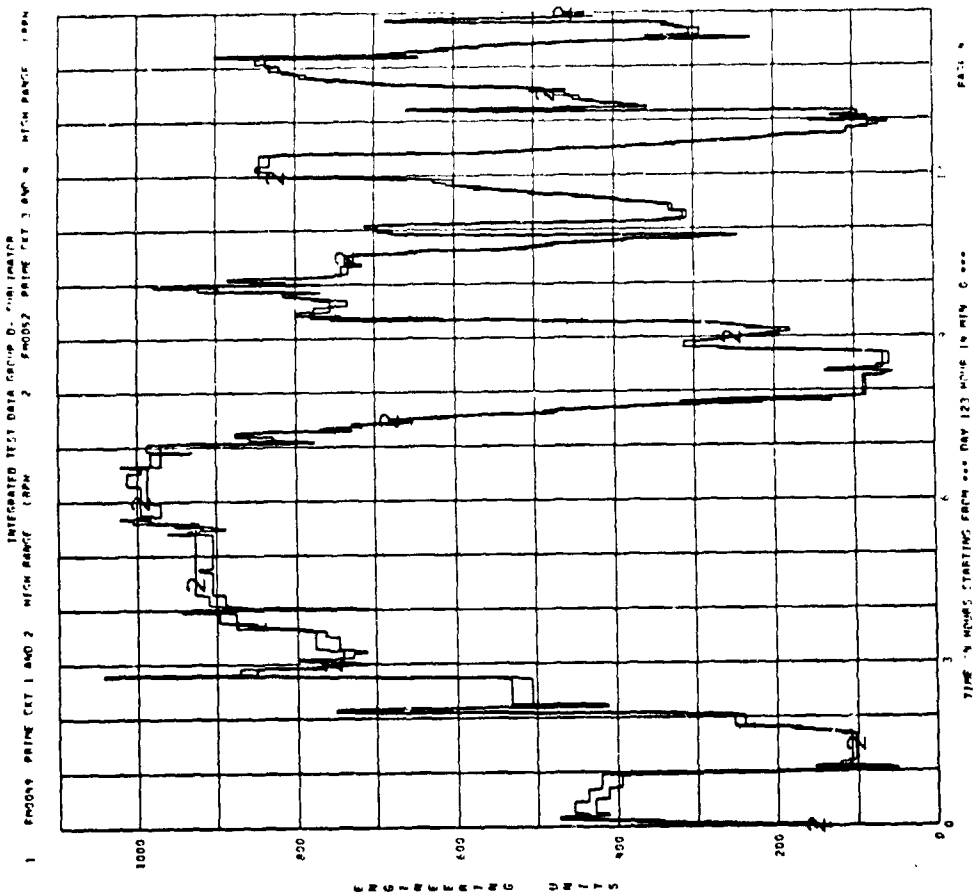
D-1



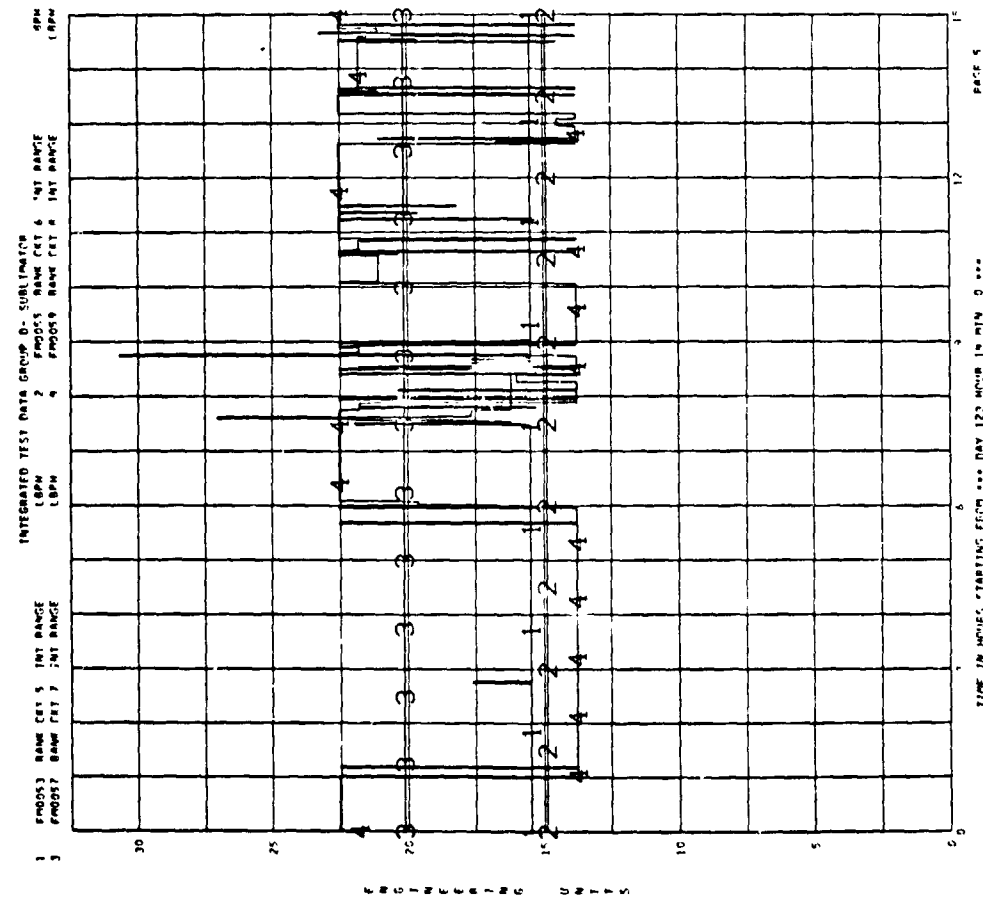
D-2



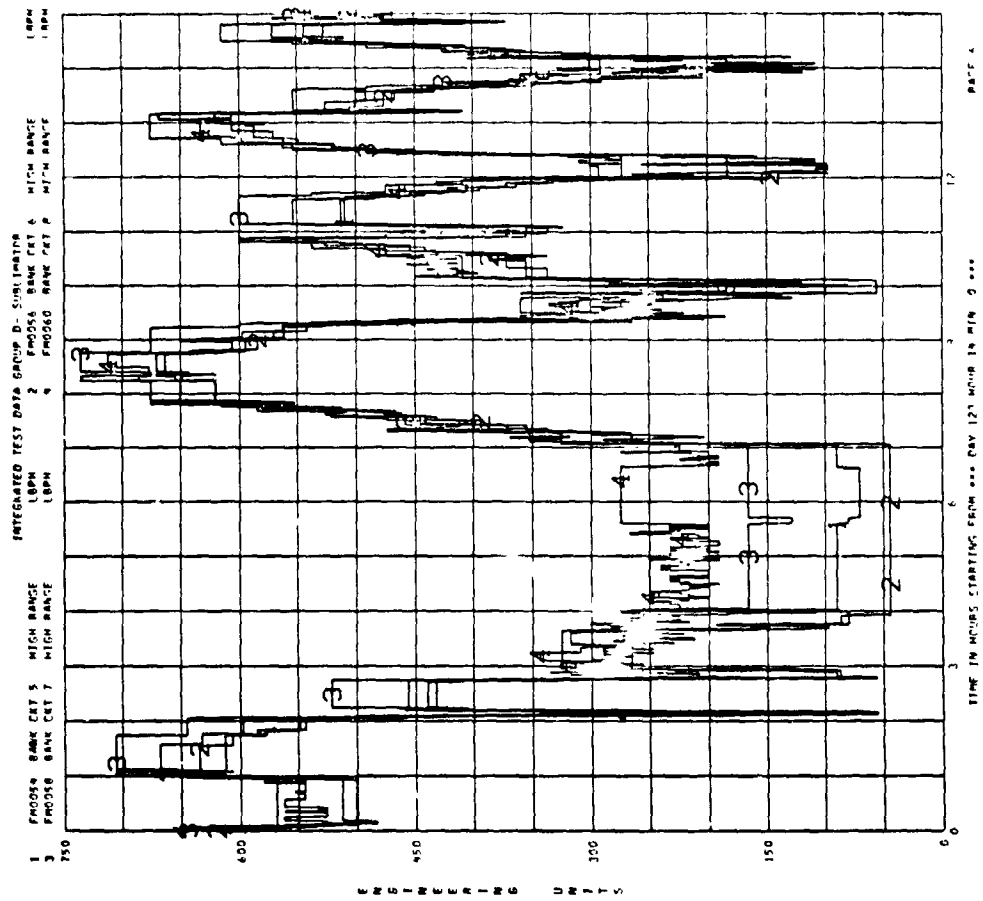
D-3



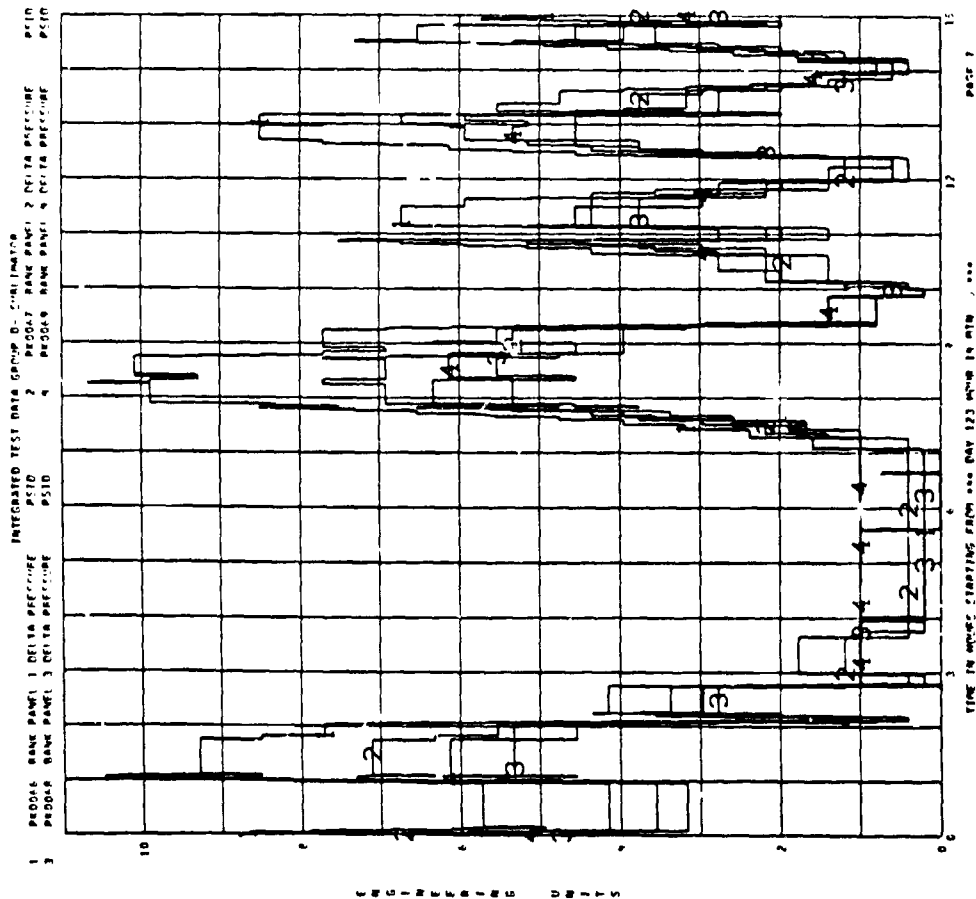
D-4



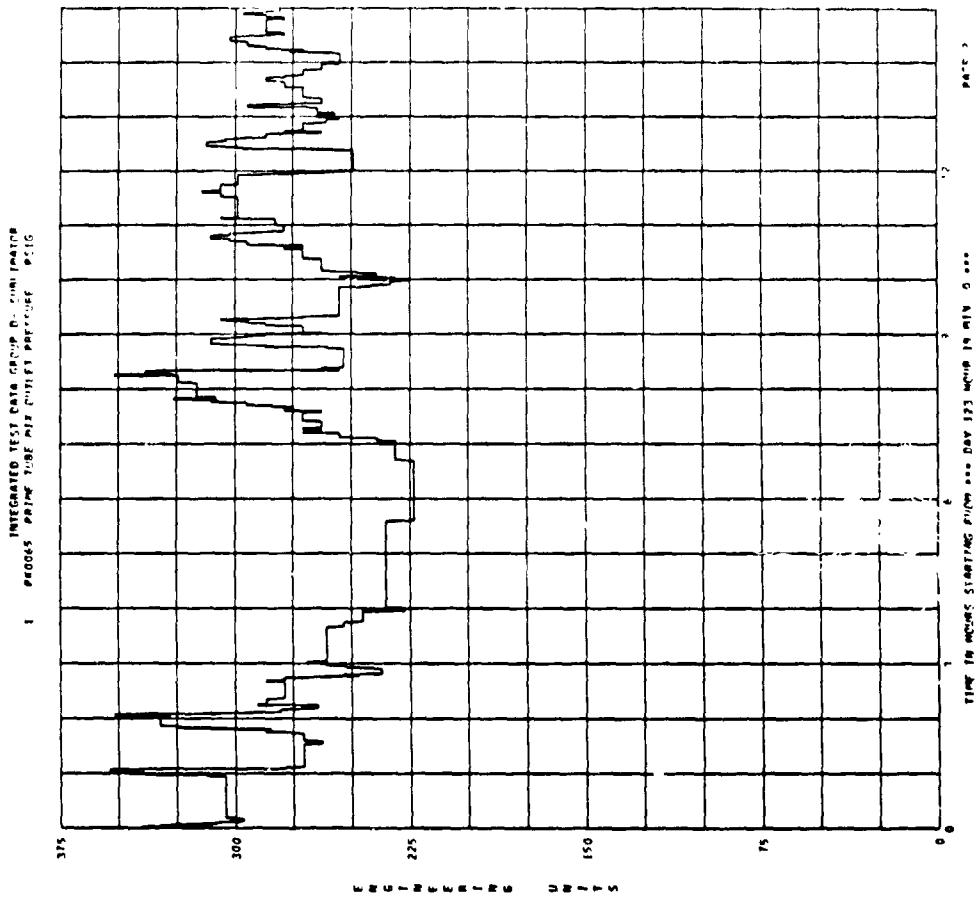
D-5



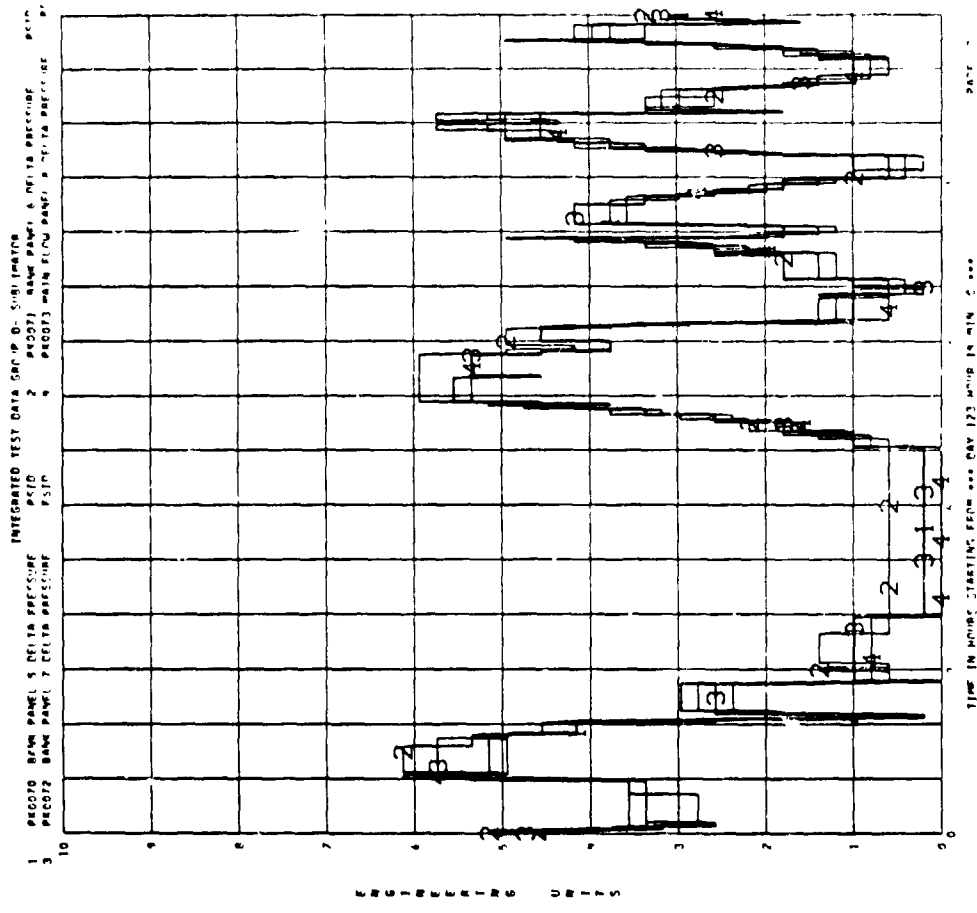
D-6



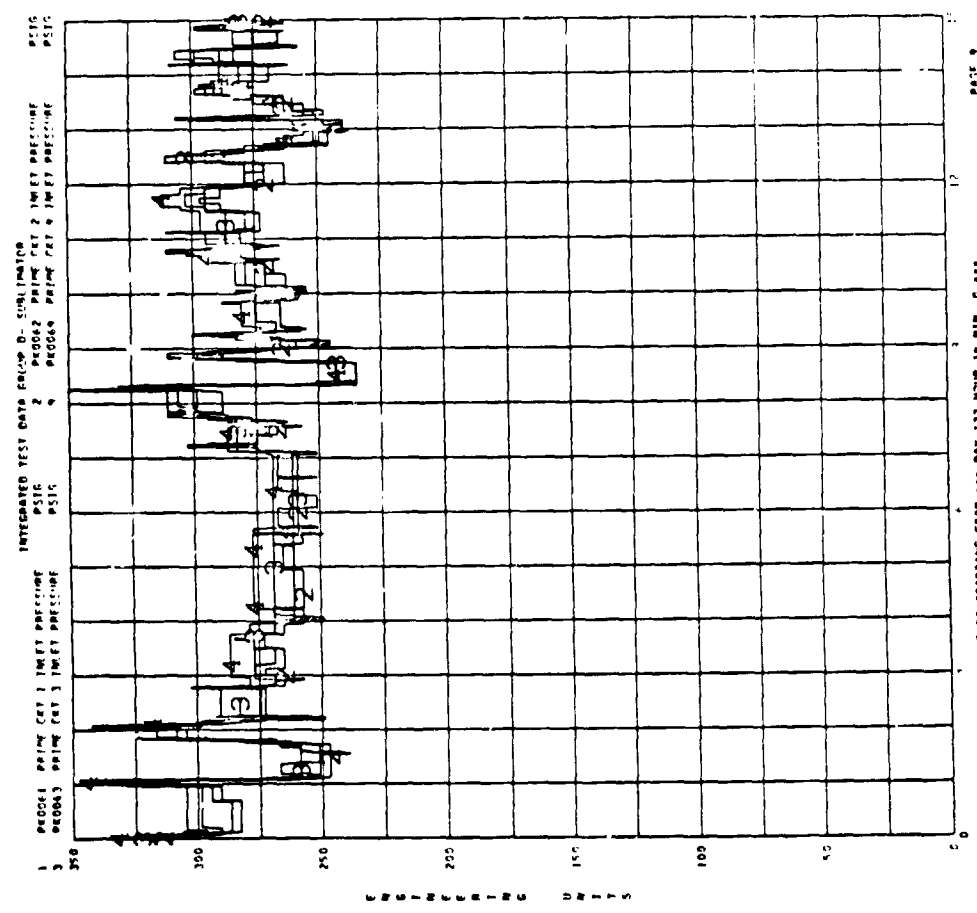
D-7



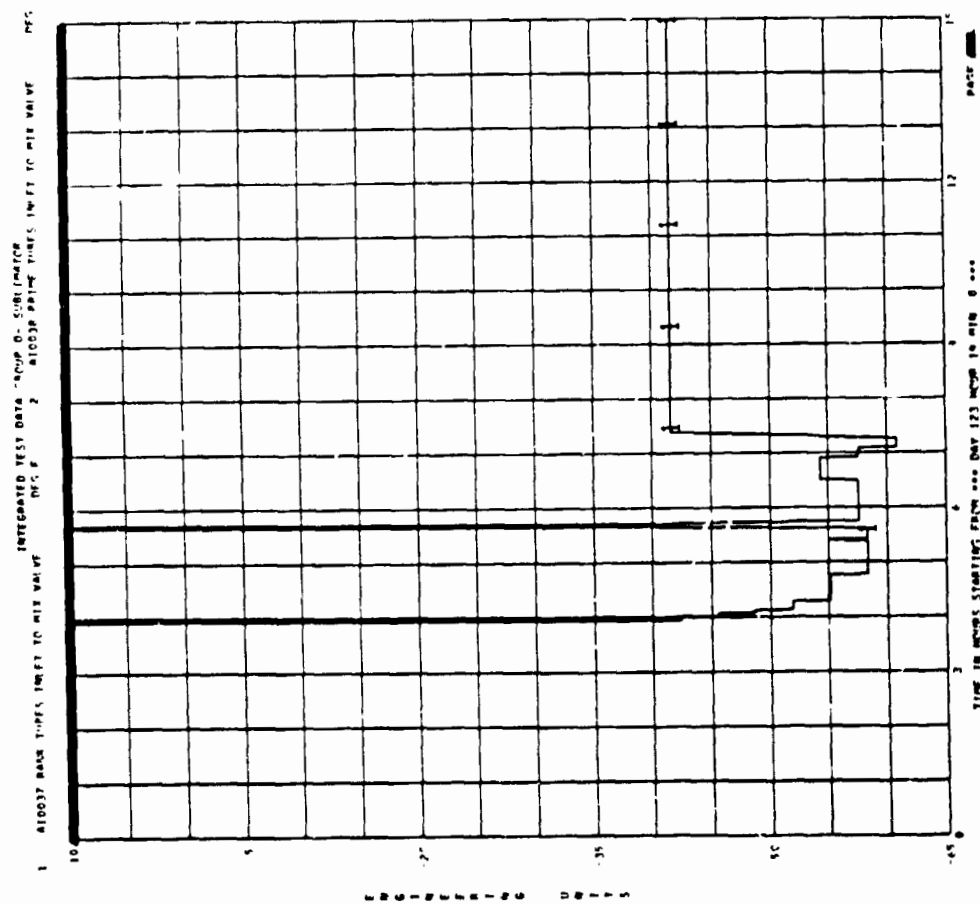
D-8



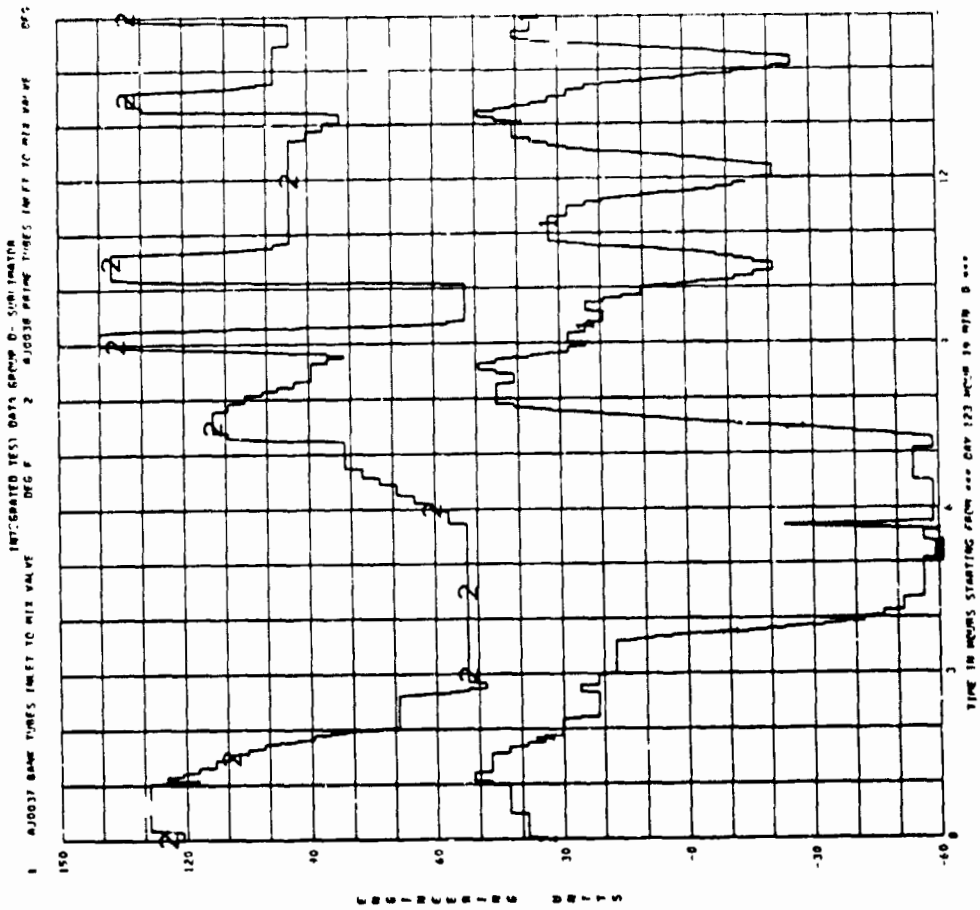
D-10



D-9

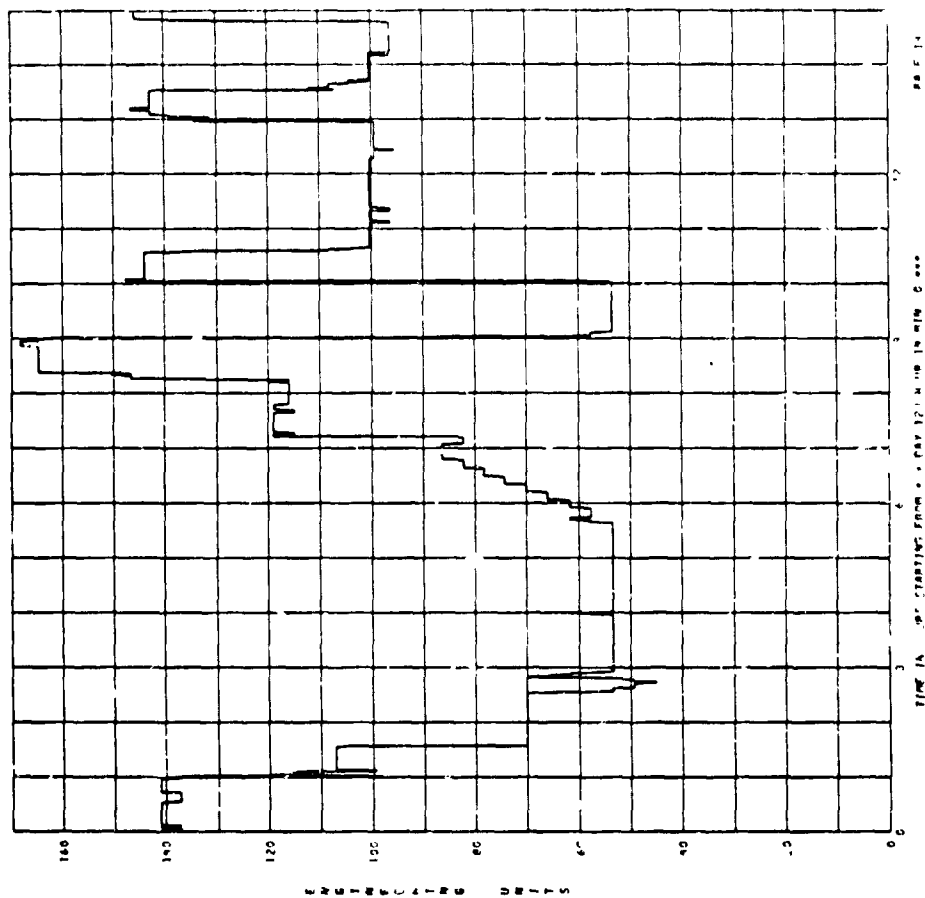


D-11



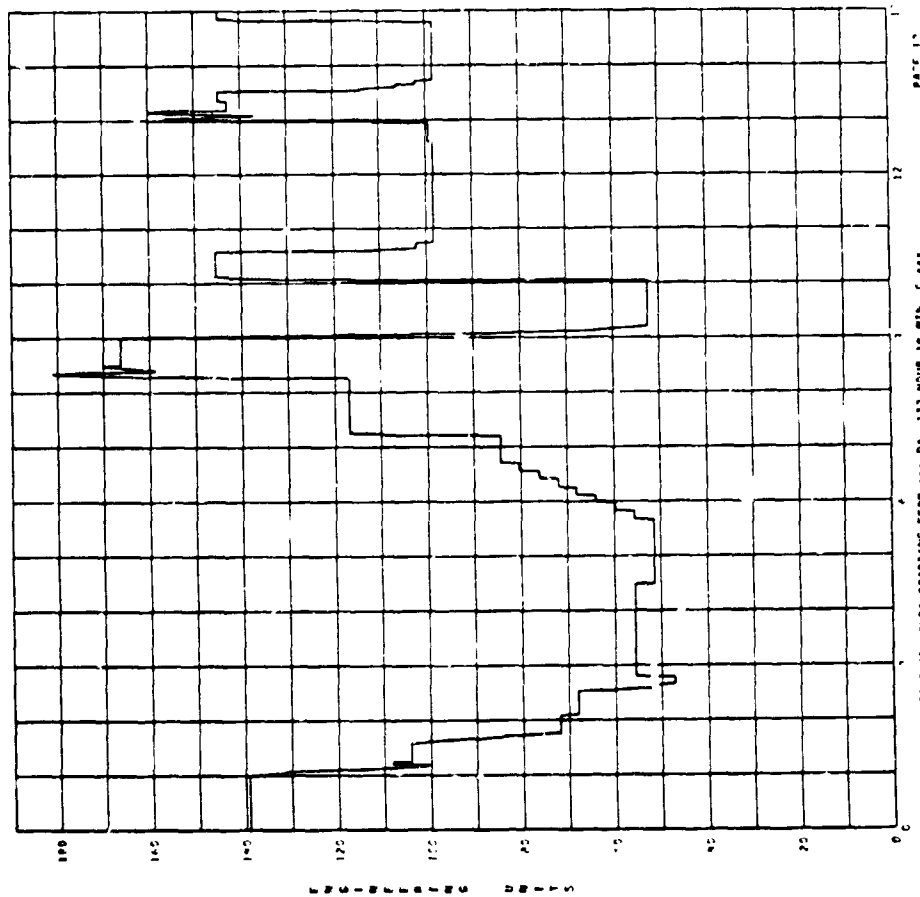
D-12

INTEGRATED TEST DATA GROUP D- SIMULATED
 1 A10002 80W SYSTEM INLET DFC F



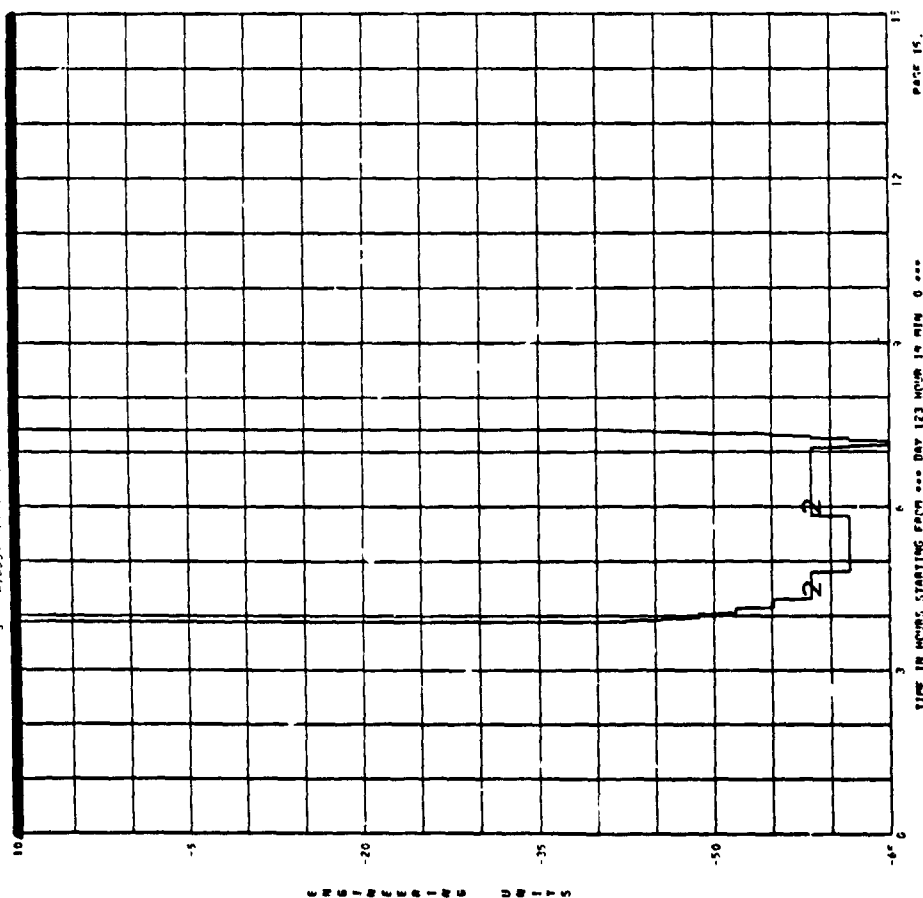
D-14

INTEGRATED TEST DATA GROUP D- SIMULATED
 1 A10001 80W SYSTEM INLET DFC F



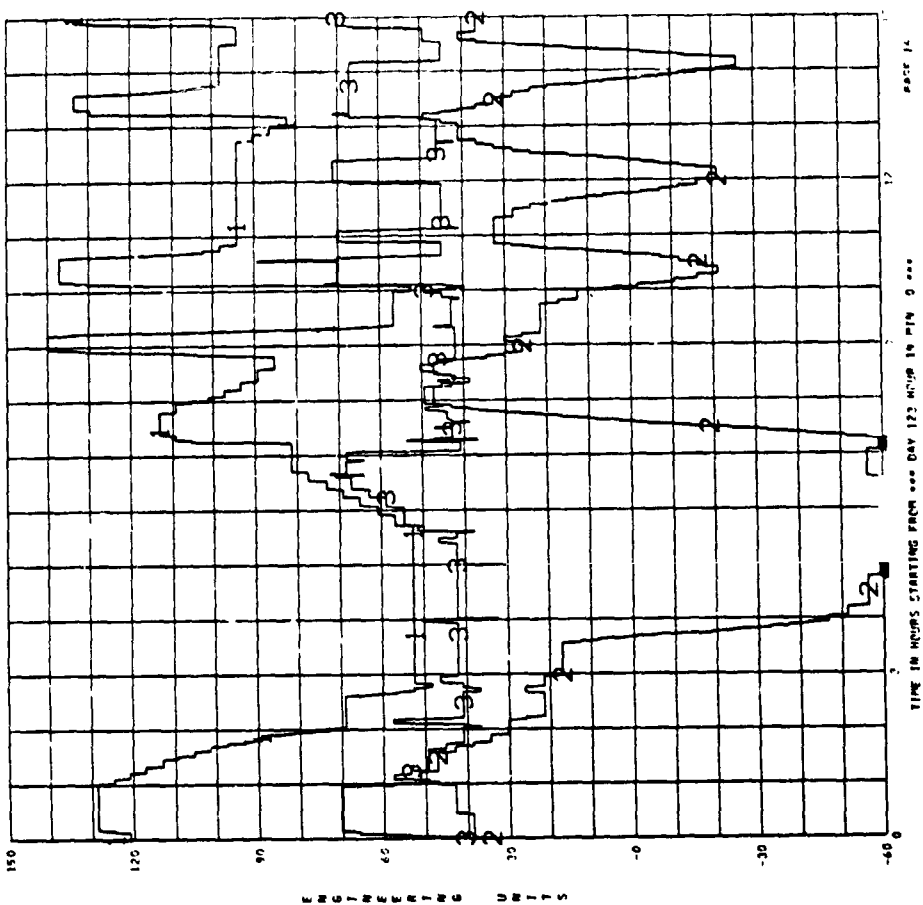
D-13

INTEGRATED TEST DATA GROUP D- SUBIMATOR
 1 A10019 PRIME TUBES OUTLET MIX IN CM DEG F 2 A10034 RANK TUBES OUTLET MIX IN CM DEG F
 3 A10039 MICH BANK AND PRIME

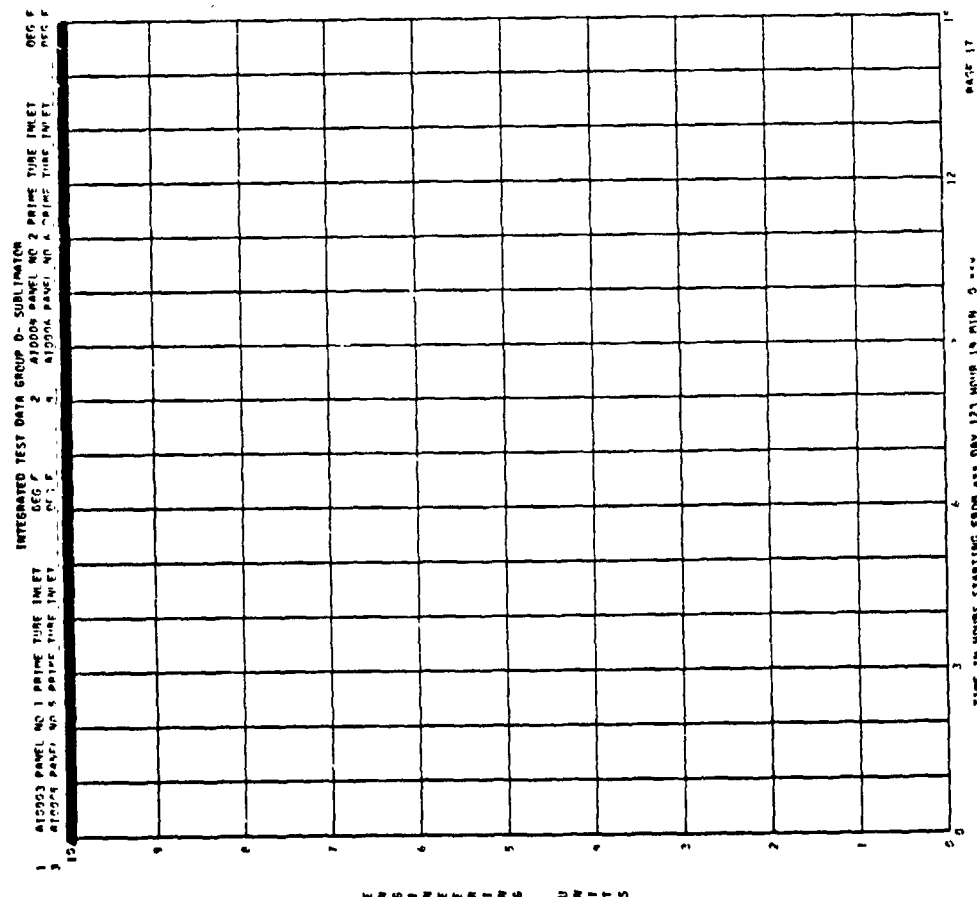


D-15

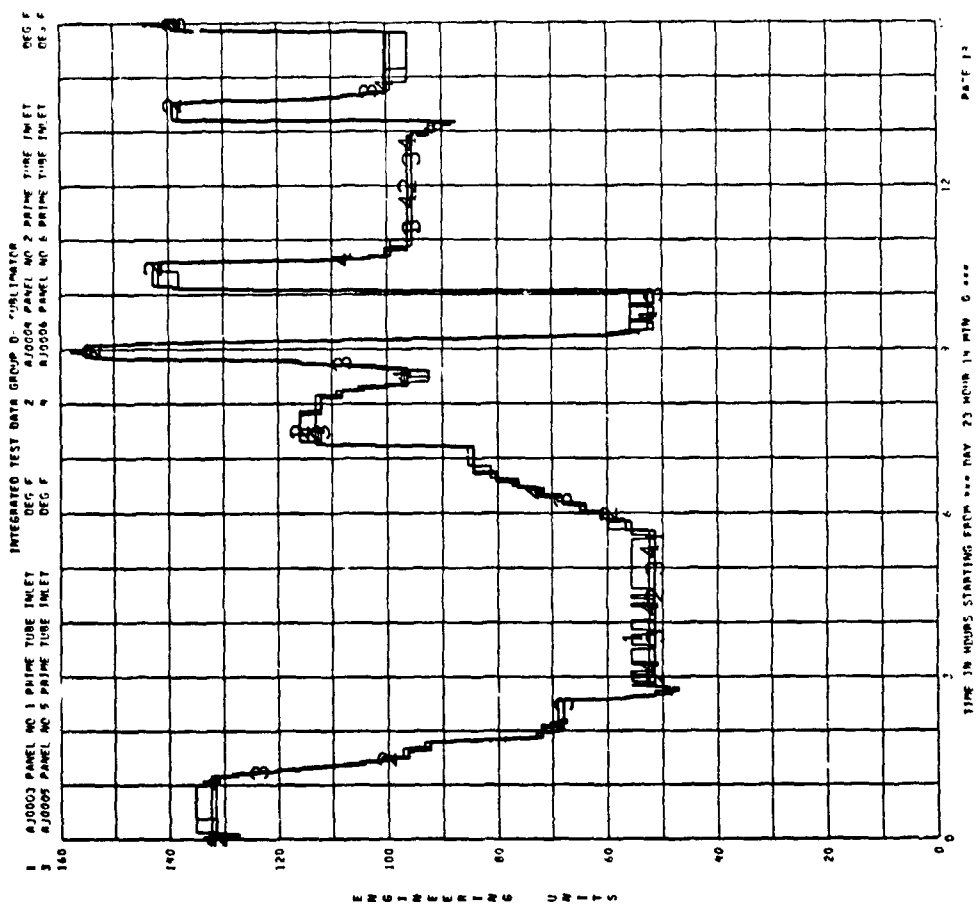
INTEGRATED TEST DATA GROUP D- SUBIMATOR
 1 A10019 PRIME TUBES OUTLET MIX IN CM DEG F 2 A10034 RANK TUBES OUTLET MIX IN CM DEG F
 3 A10039 MICH BANK AND PRIME



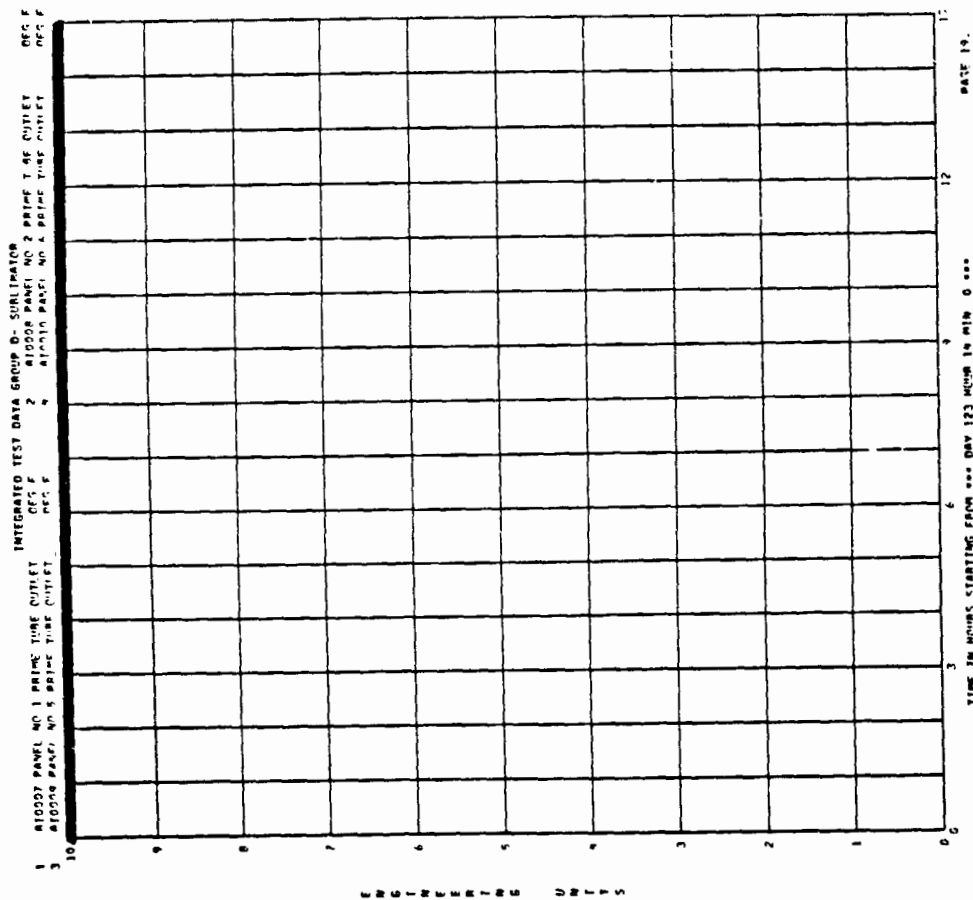
D-16



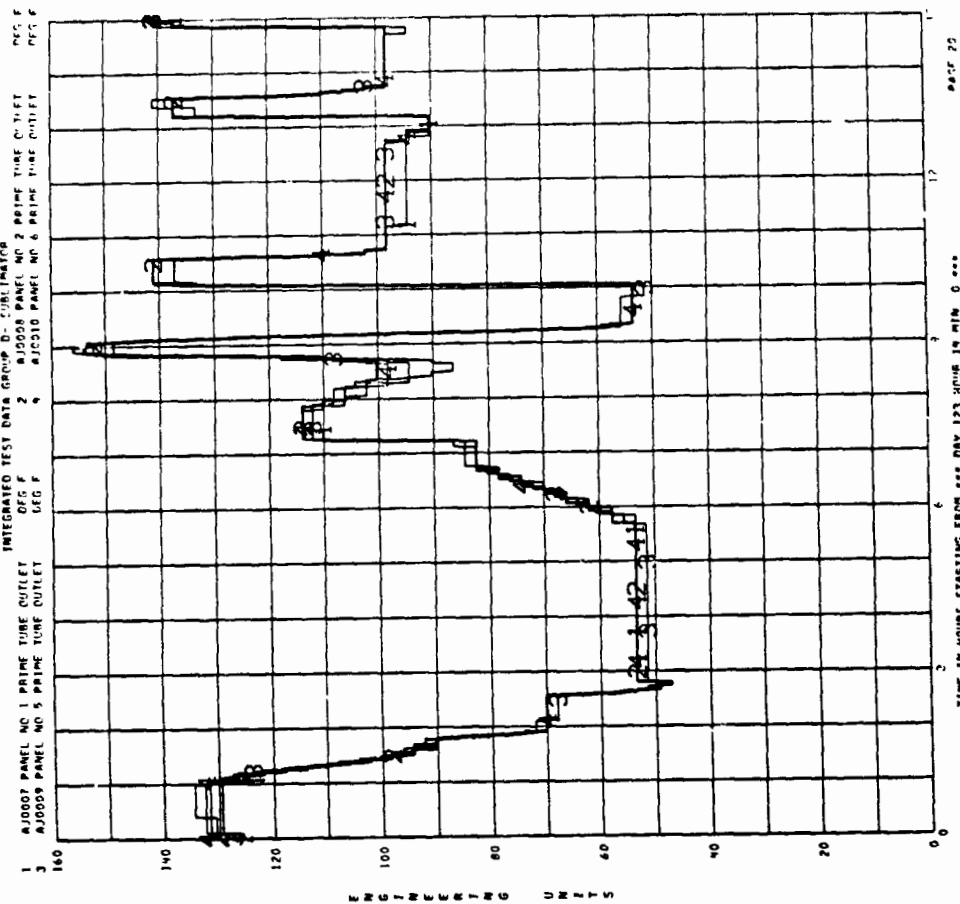
D-17



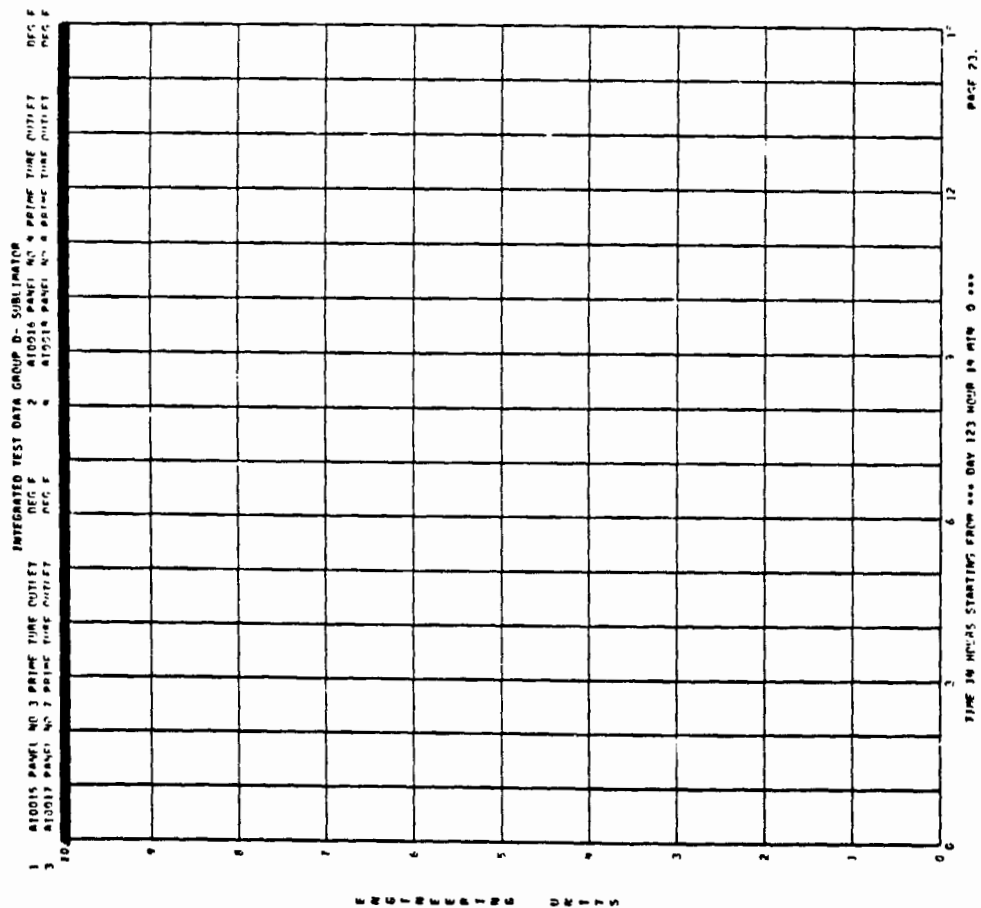
D-18



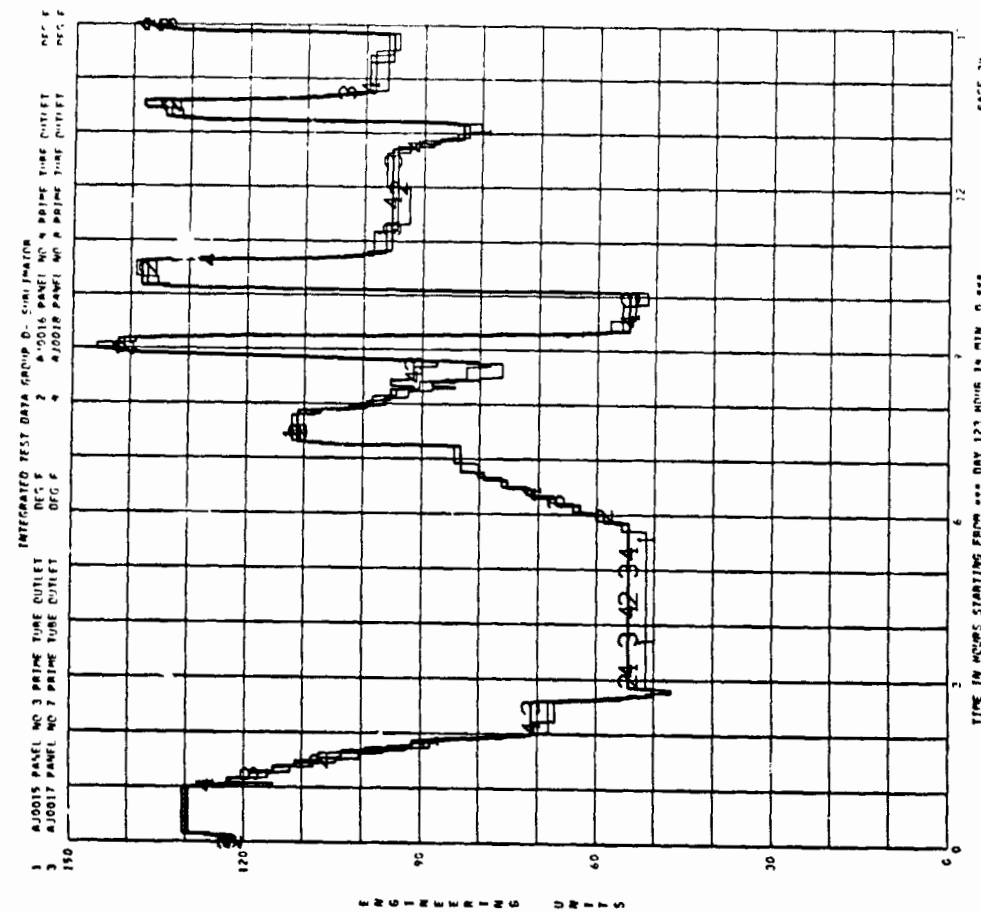
D-19



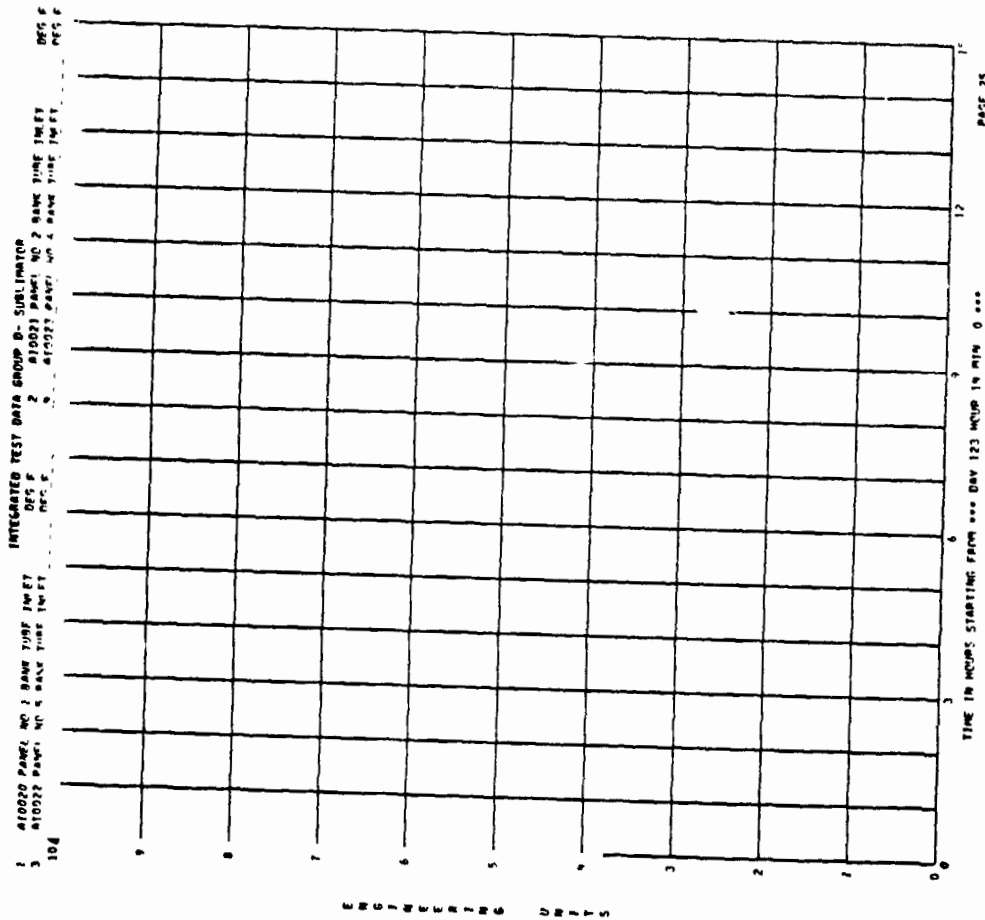
D-20



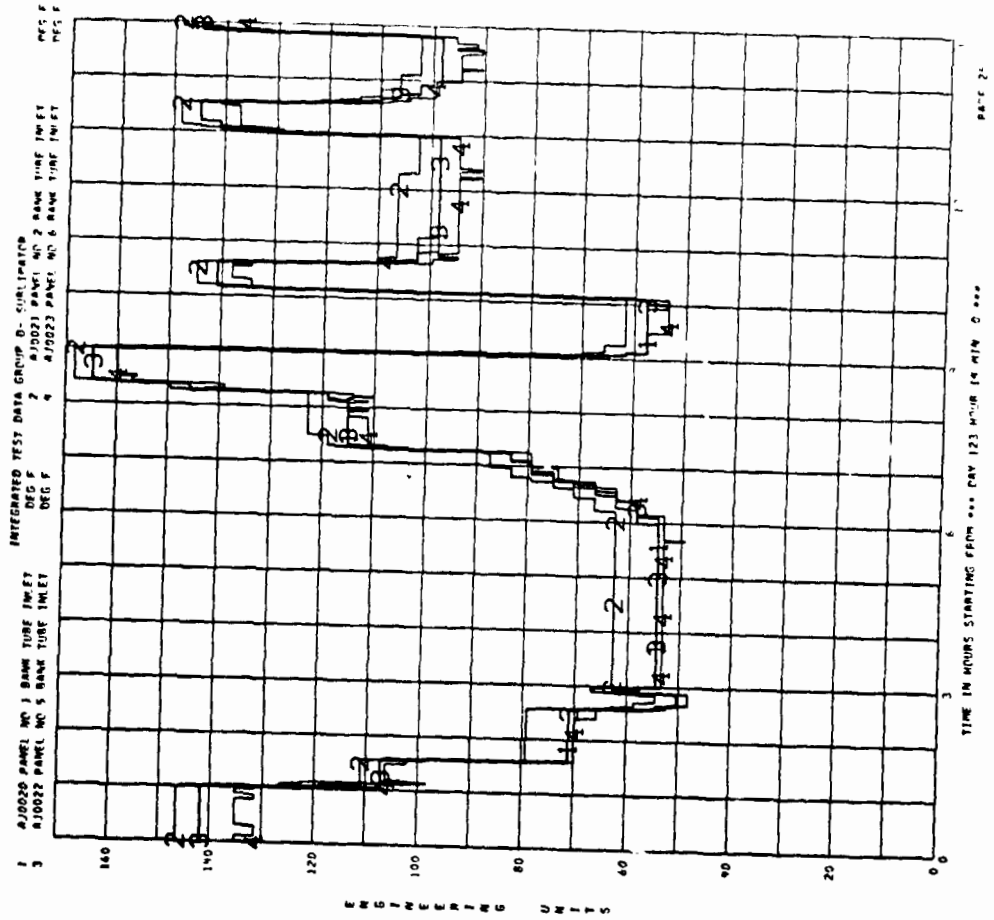
D-23



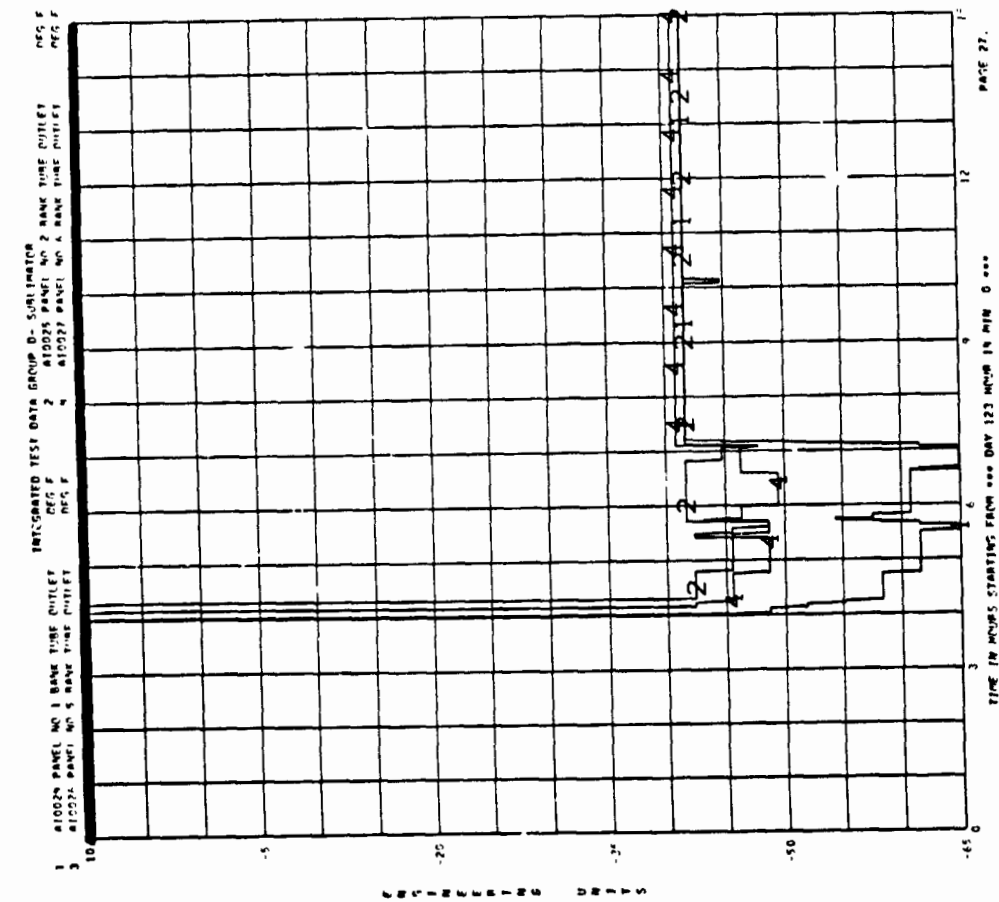
D-24



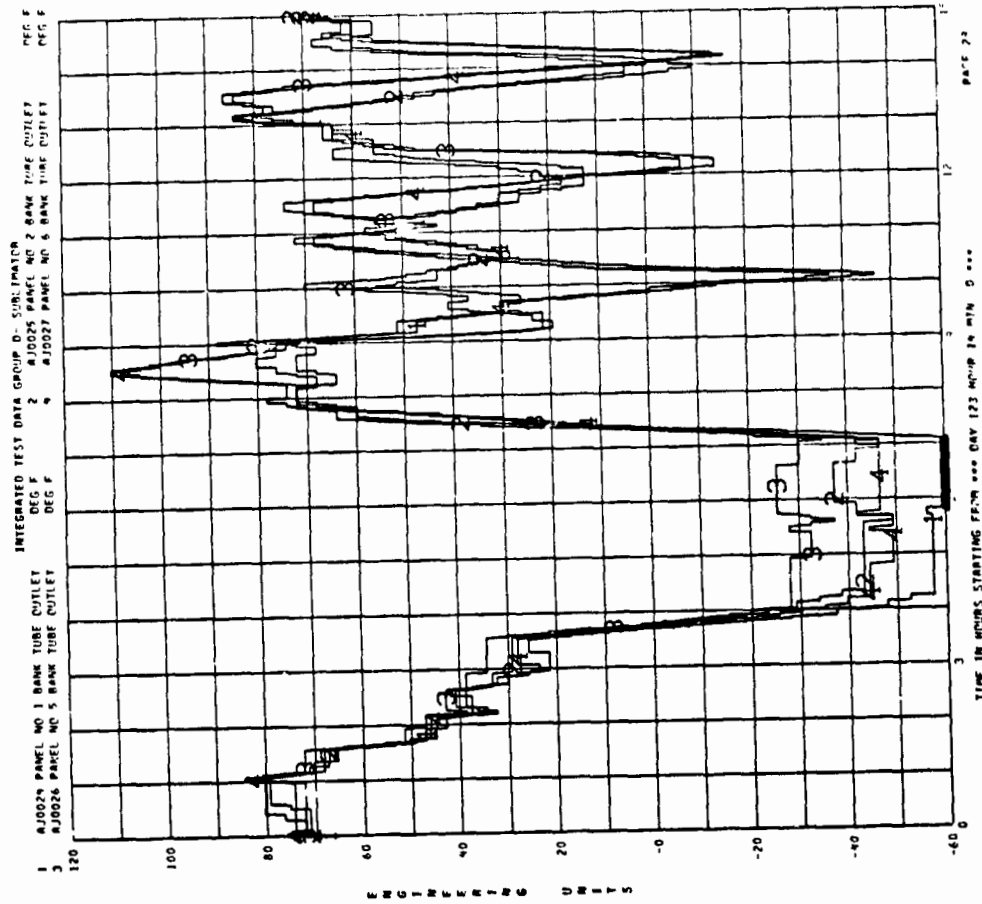
D-25



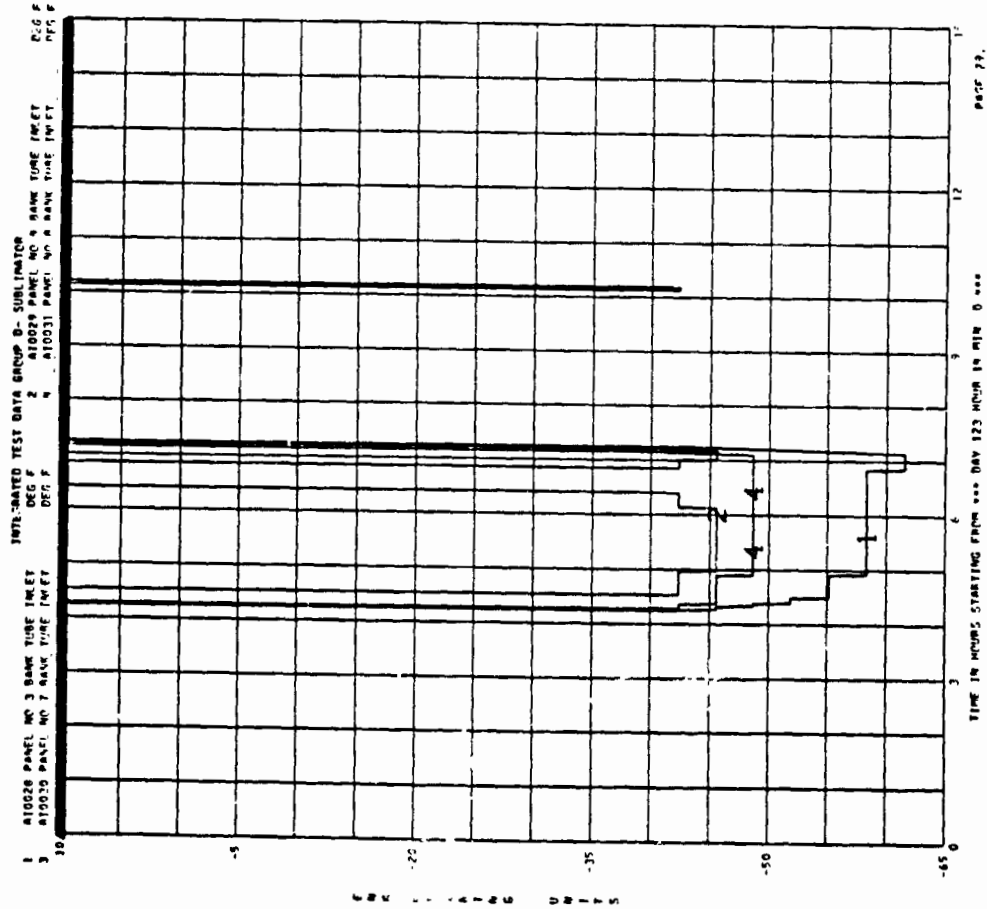
D-26



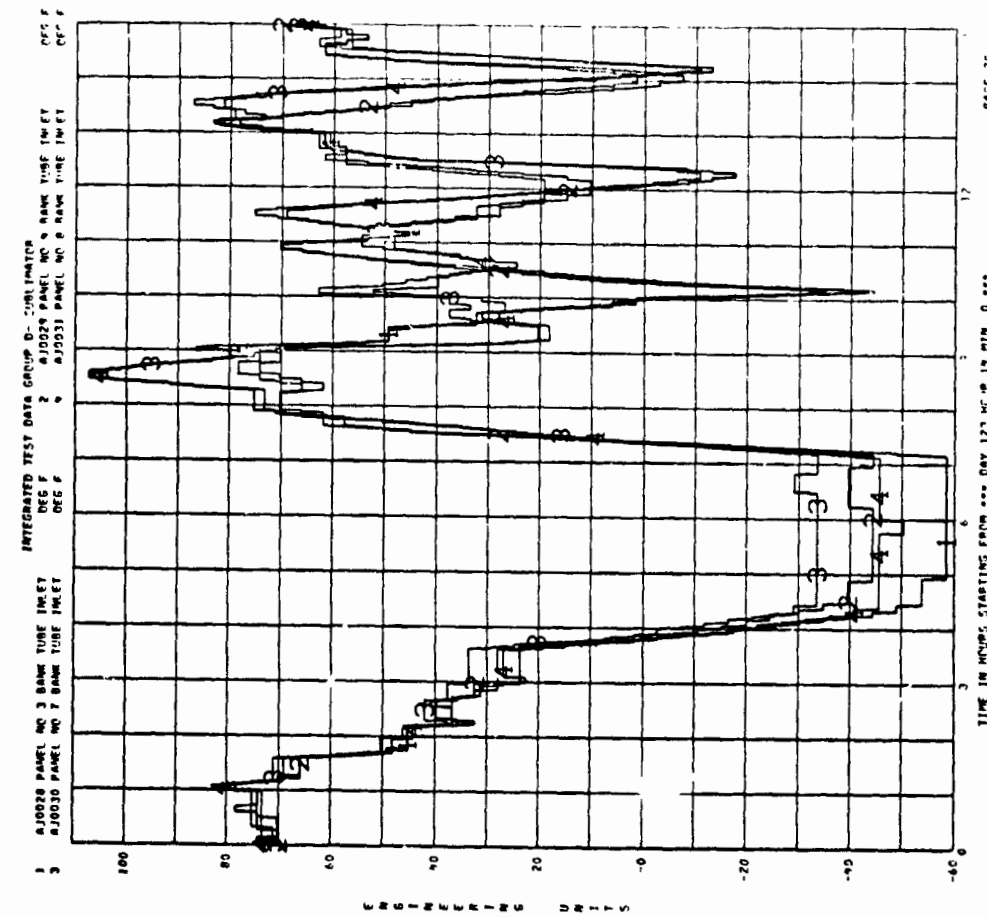
D-27



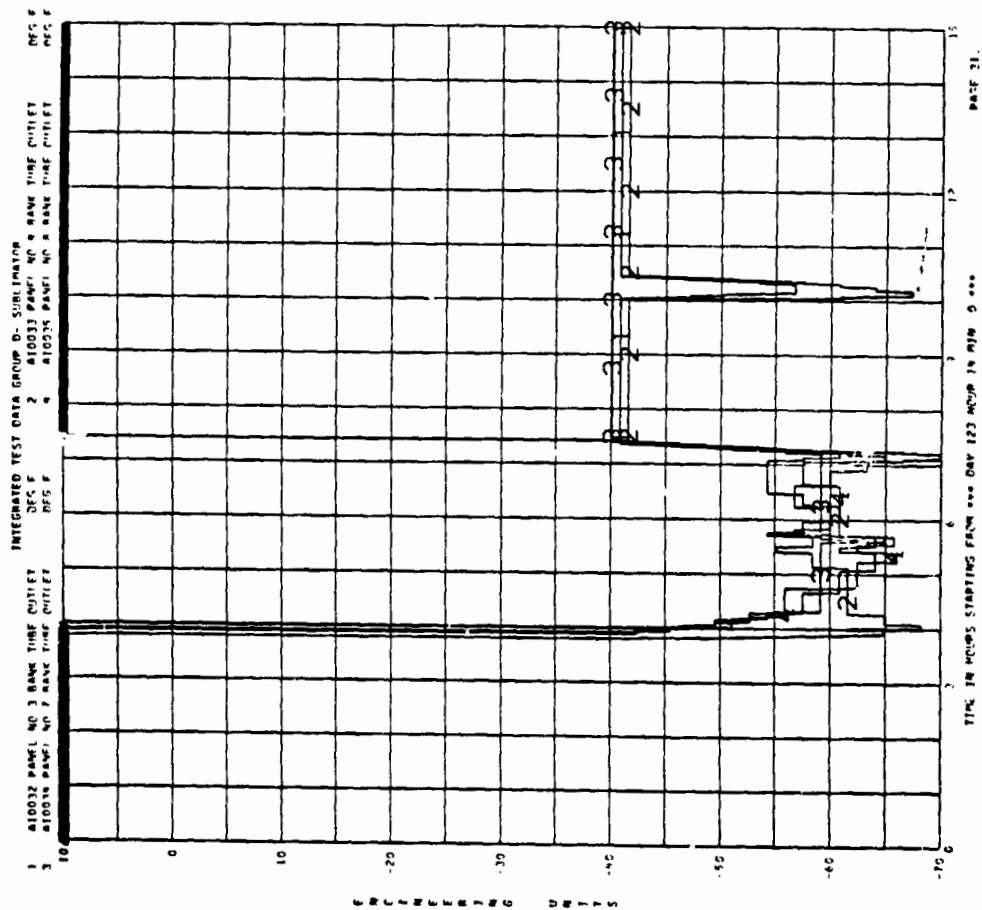
D-28



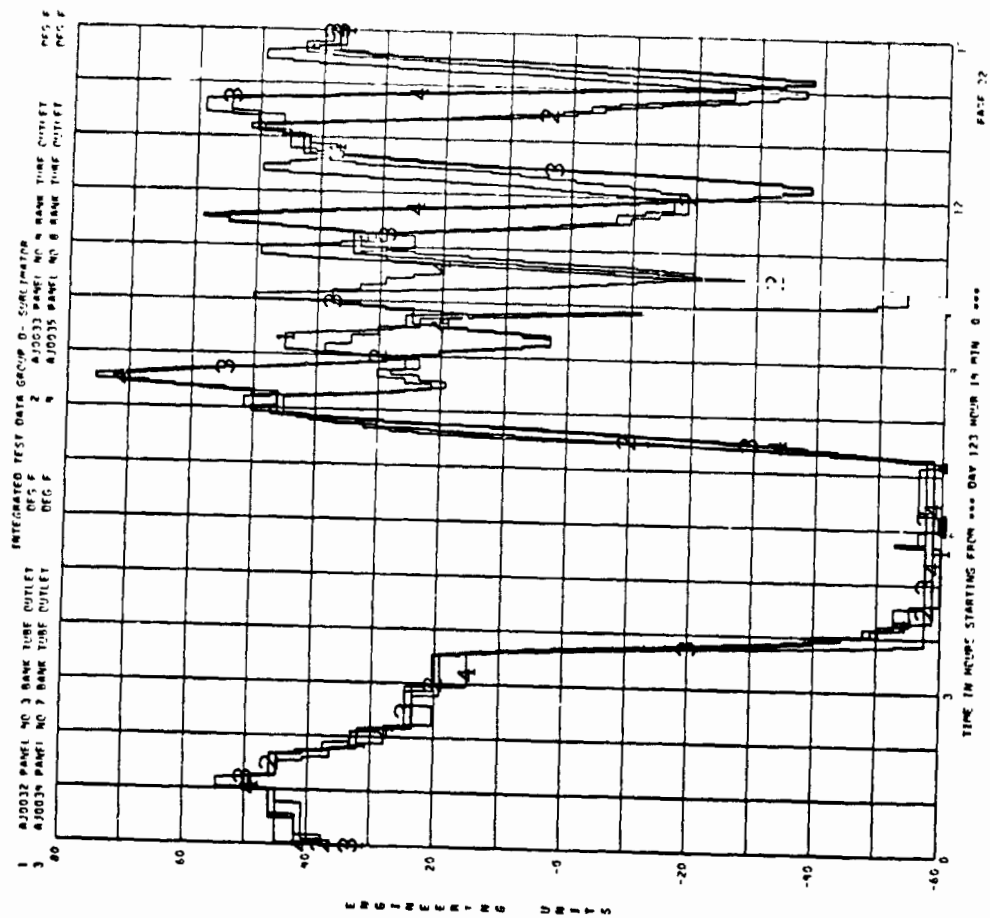
D-29



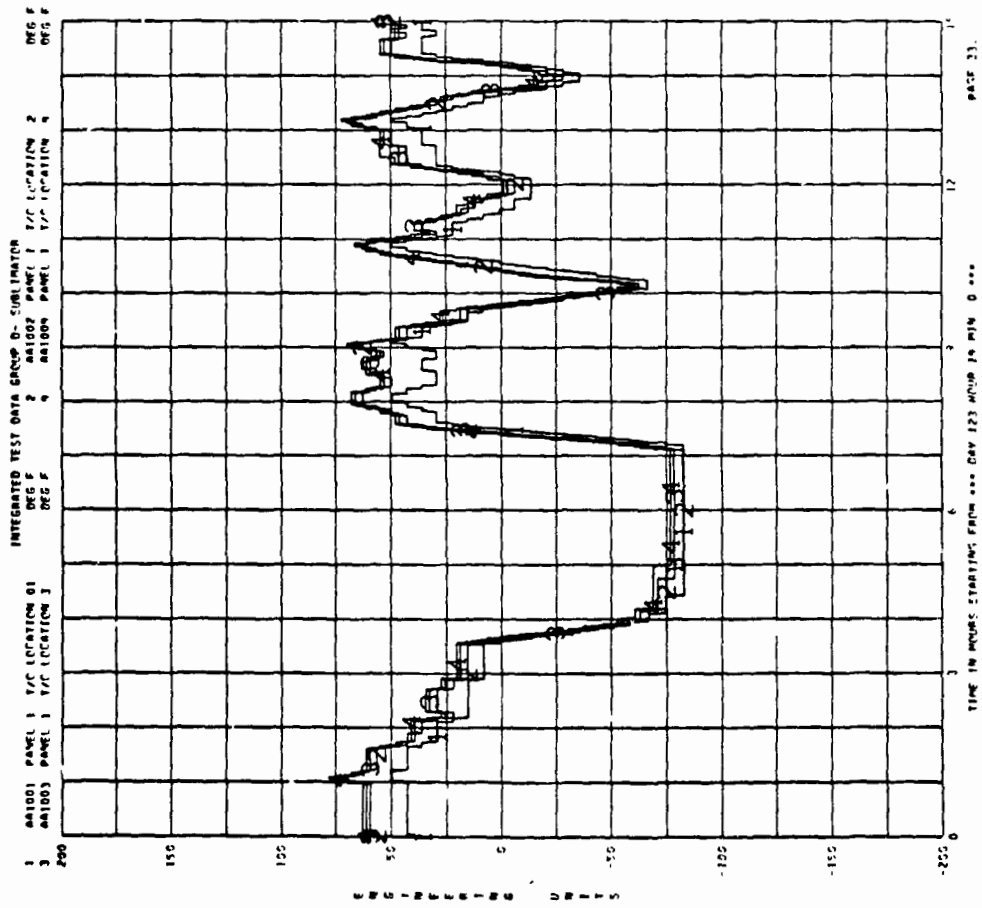
D-30



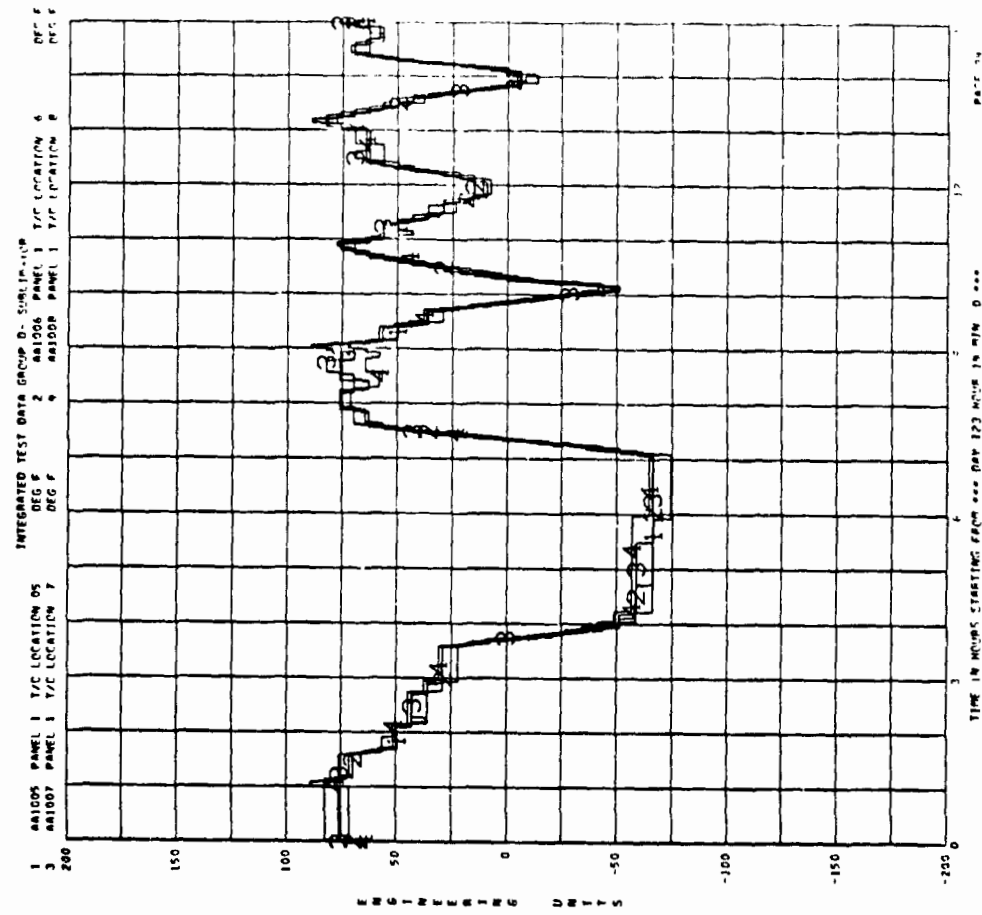
D-31



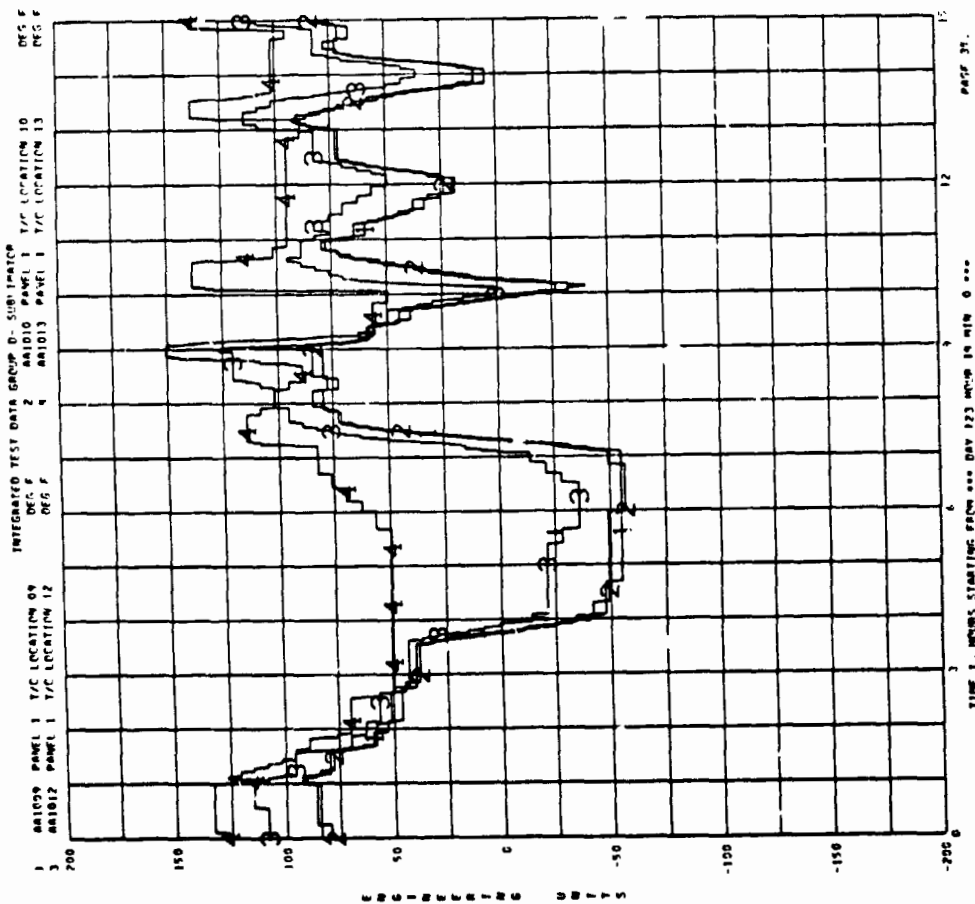
D-32



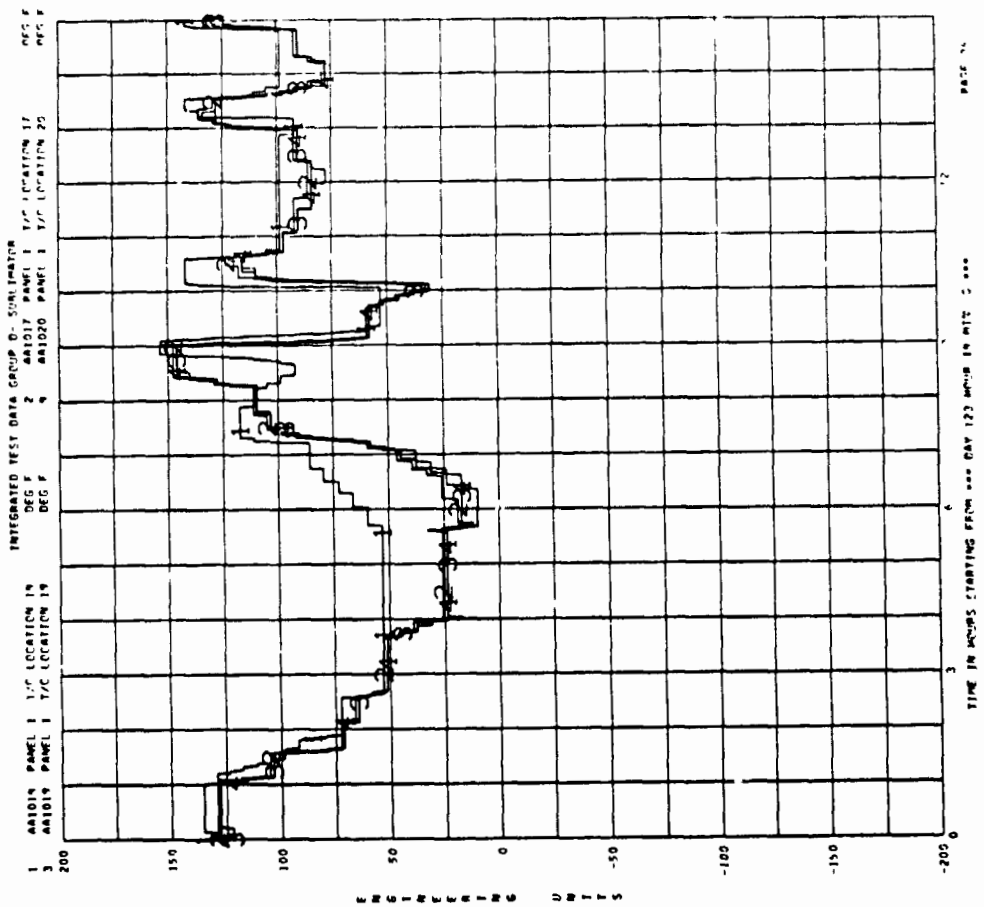
D-33



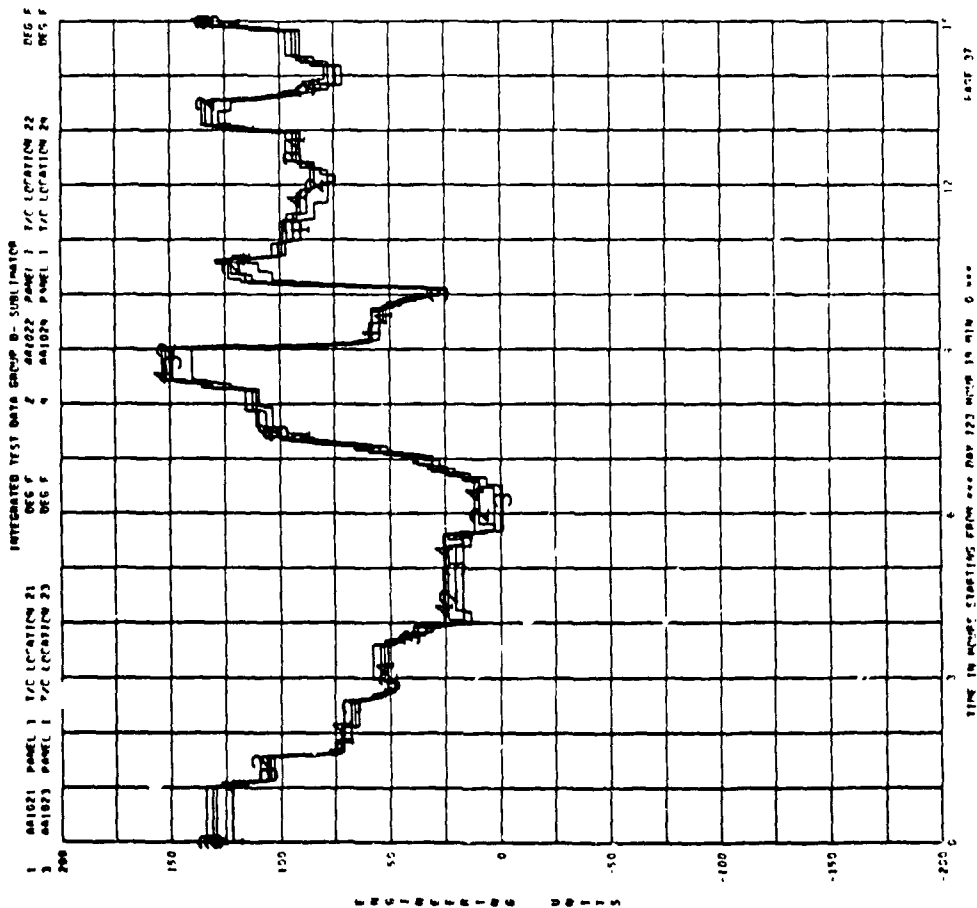
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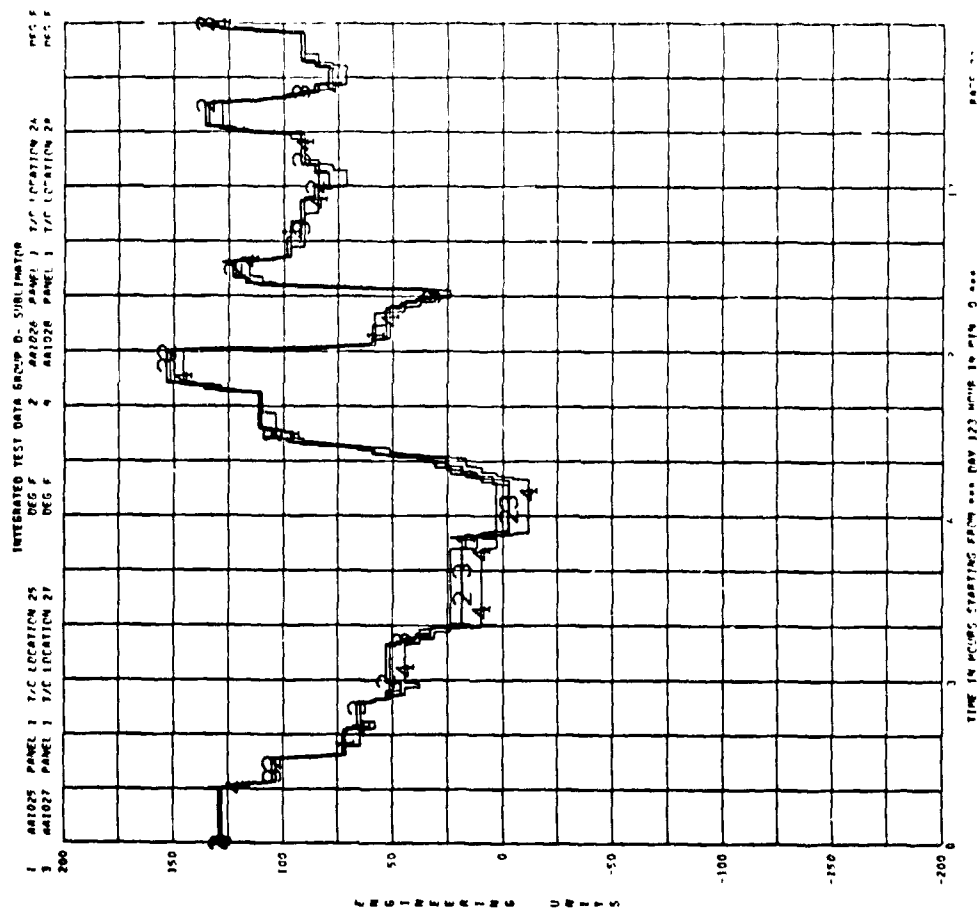
D-35



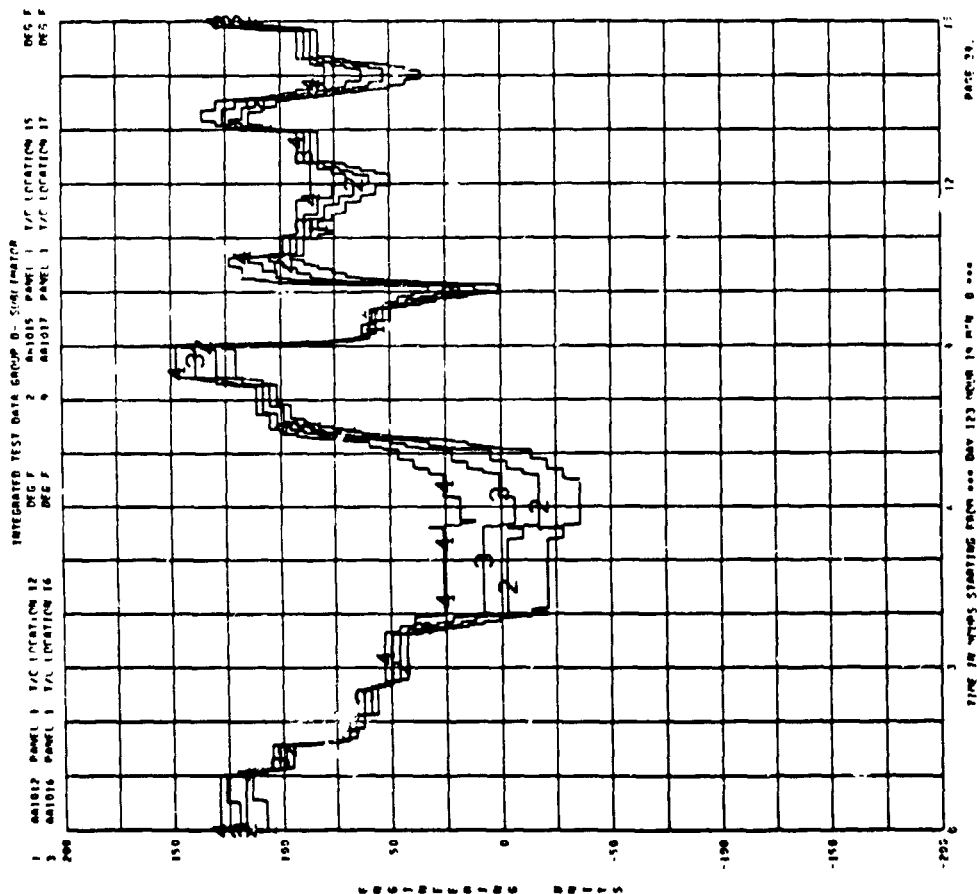
D-36



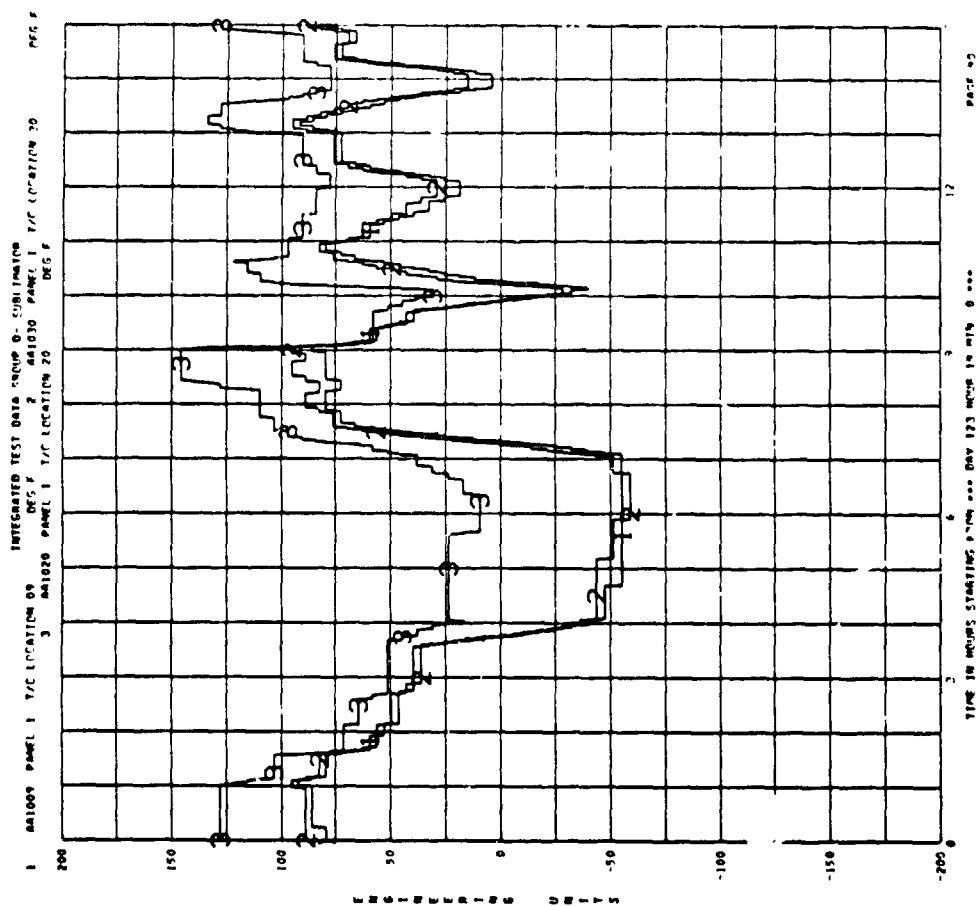
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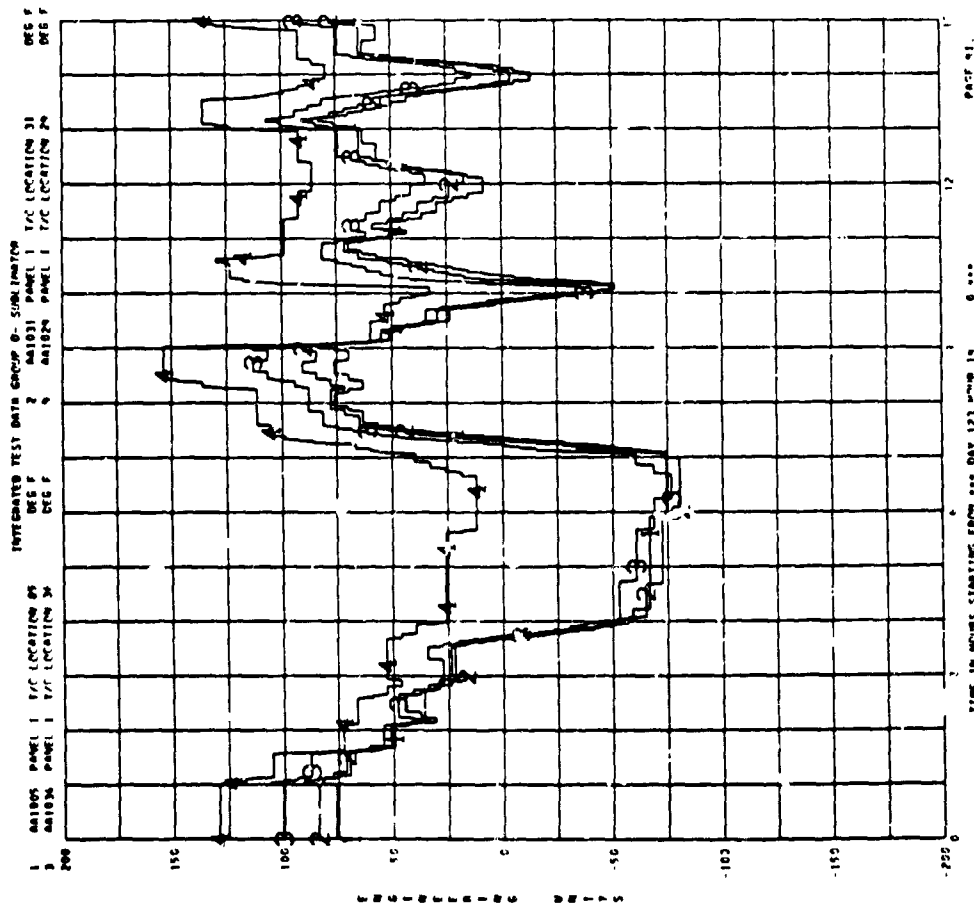
D-38



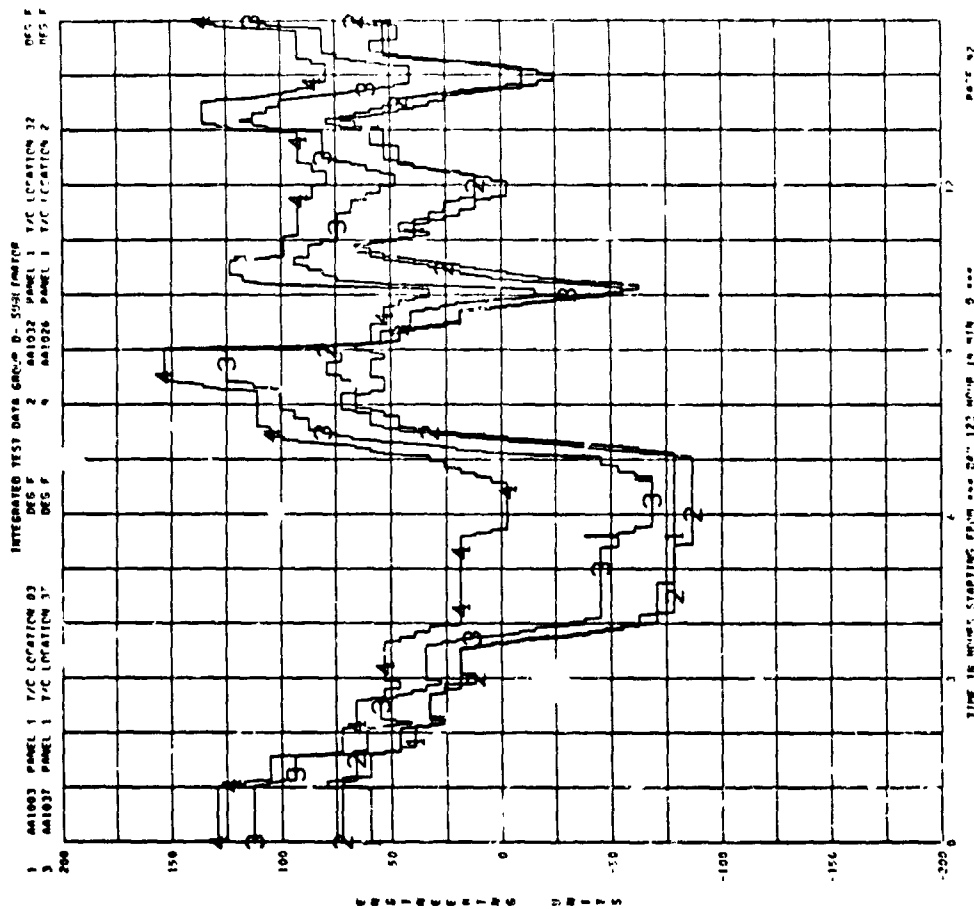
D-39



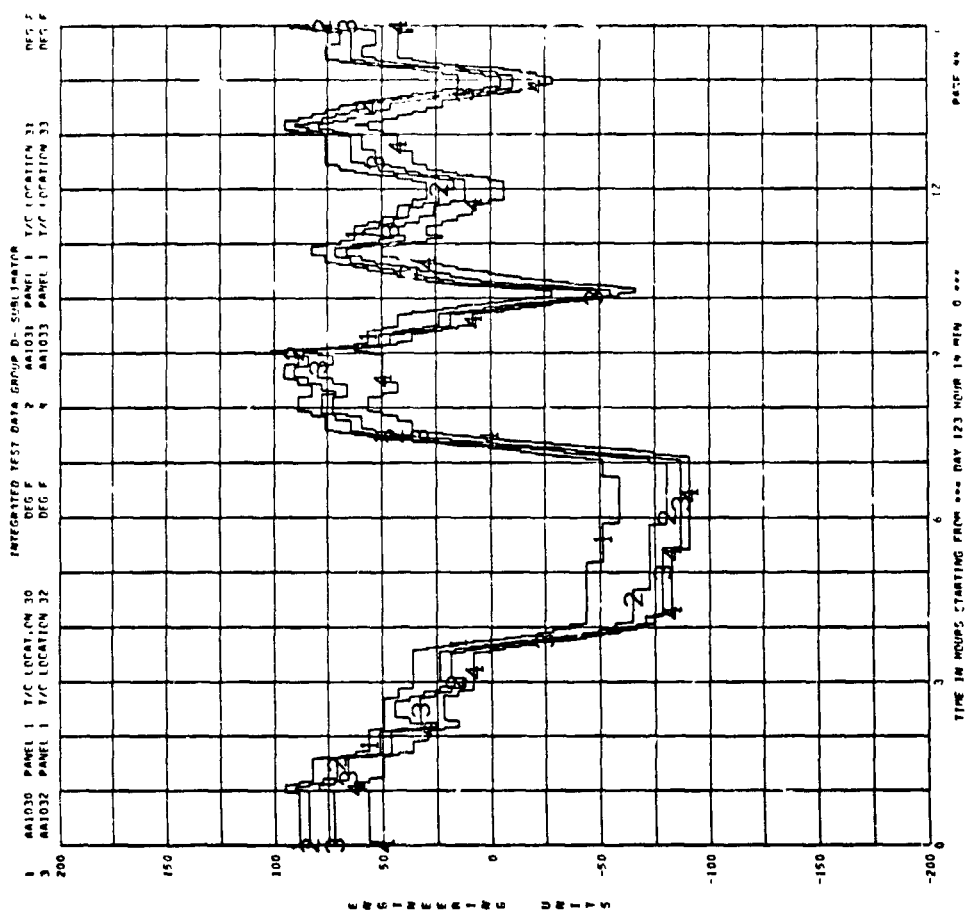
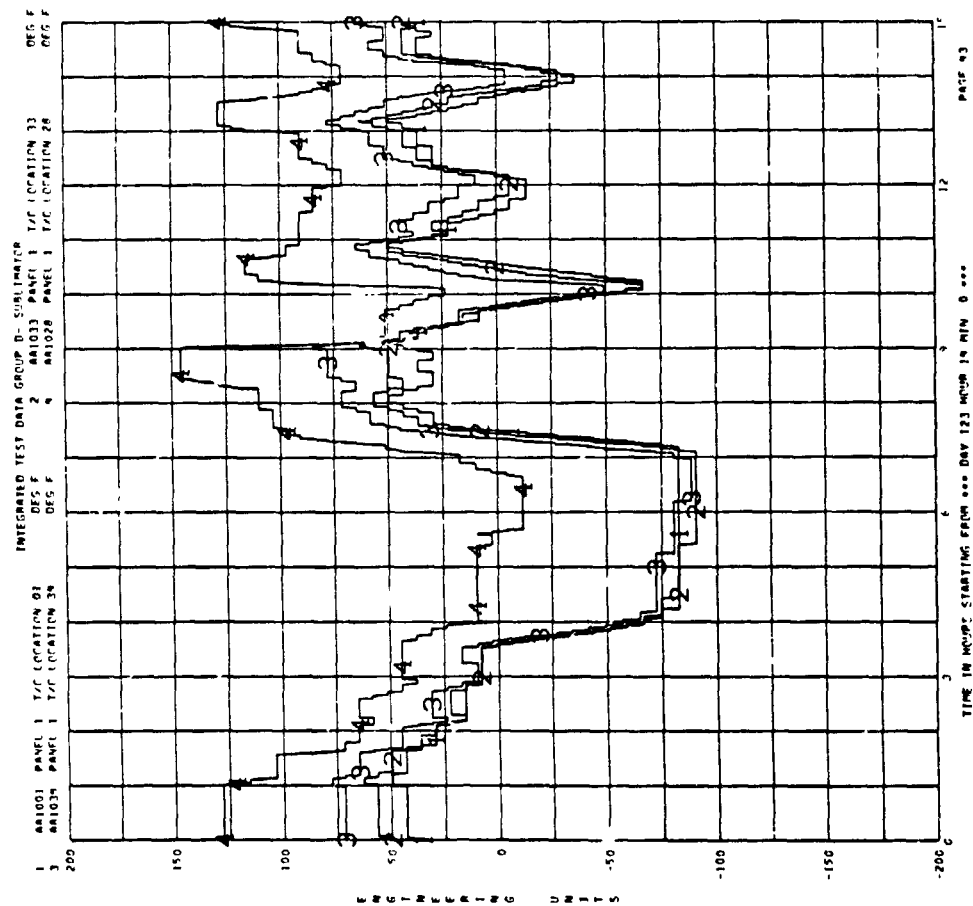
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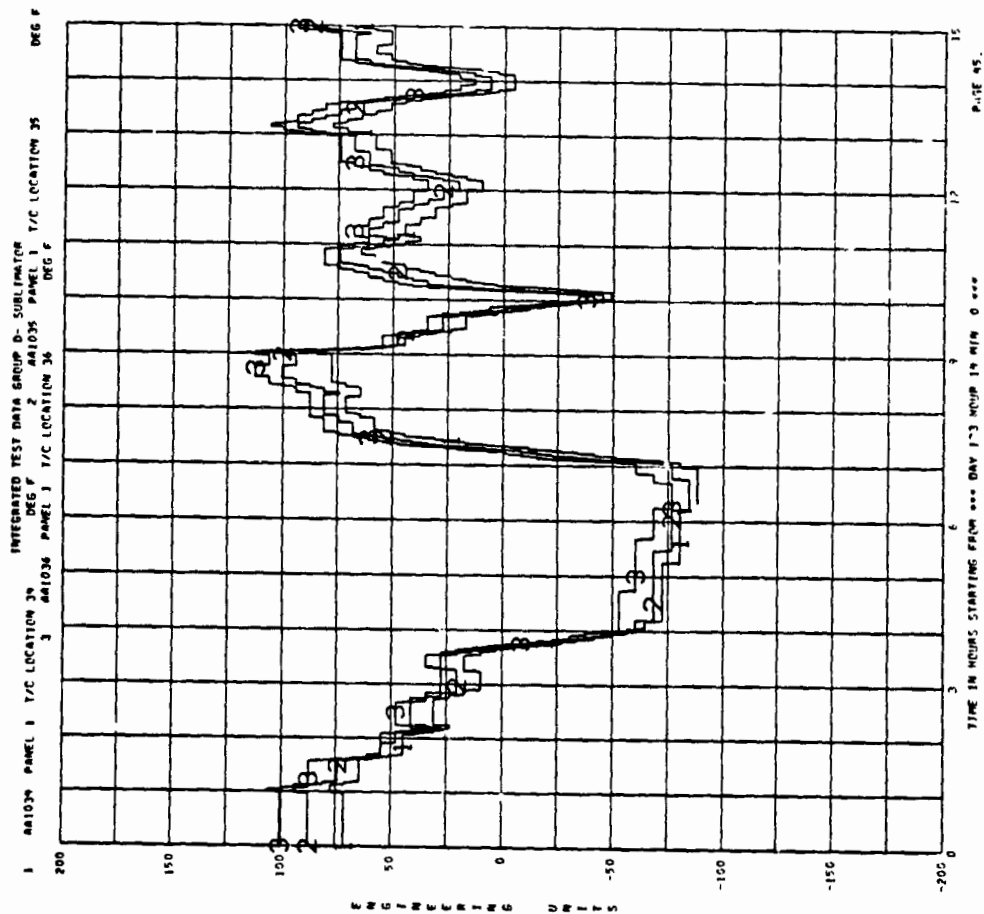


D-41

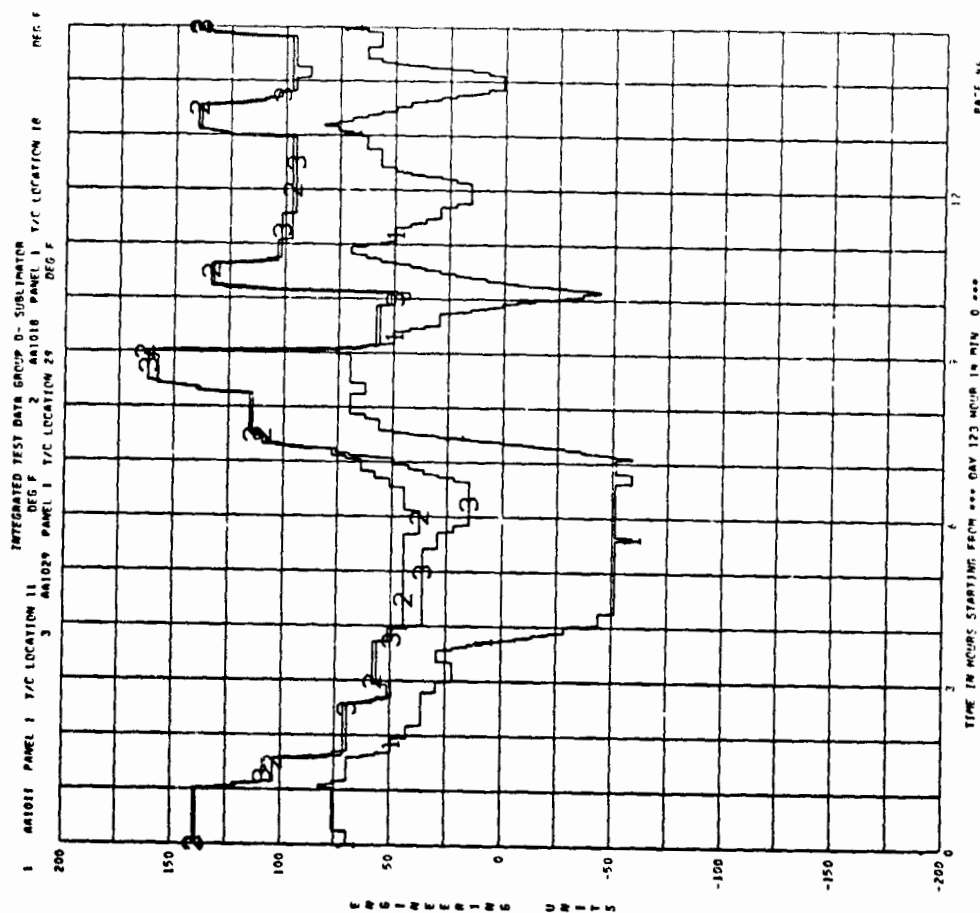


D-42

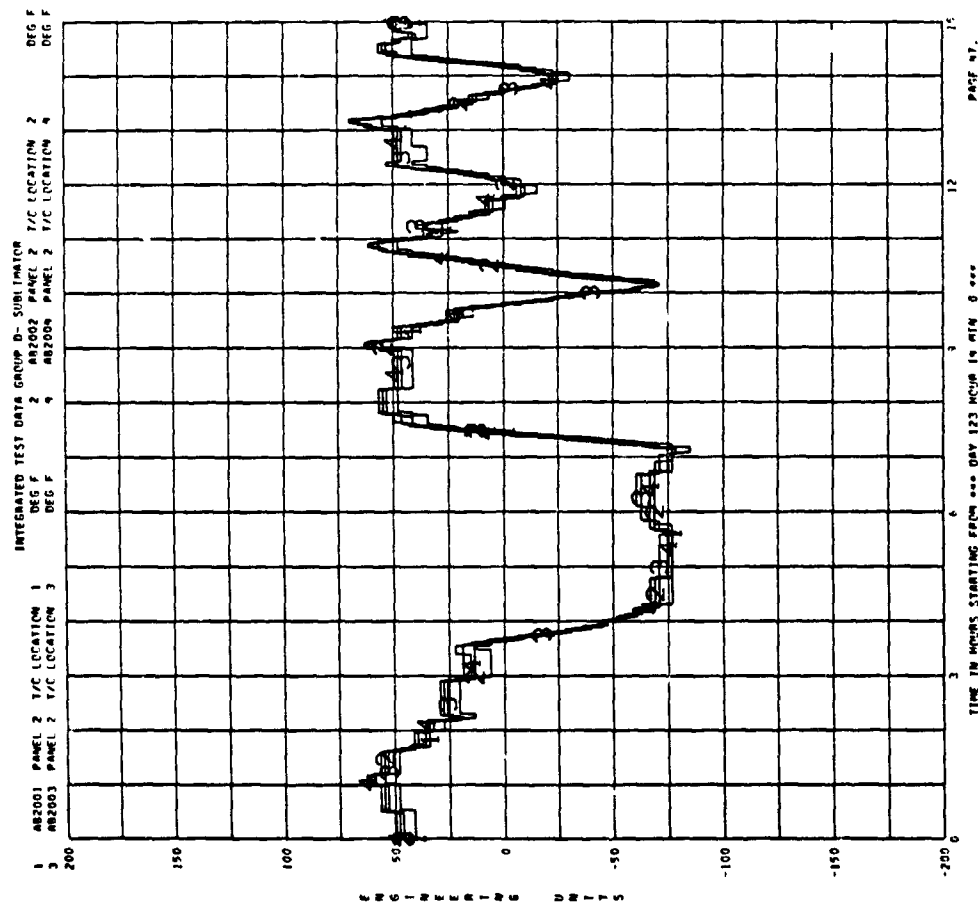




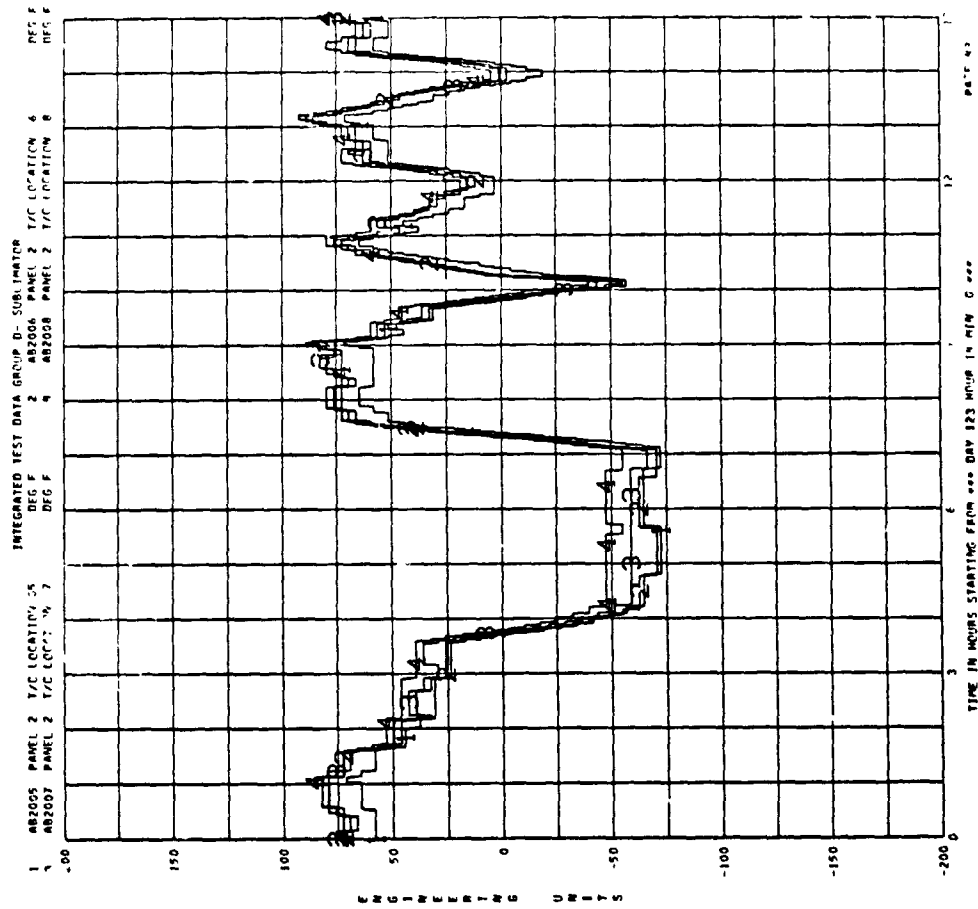
D-45



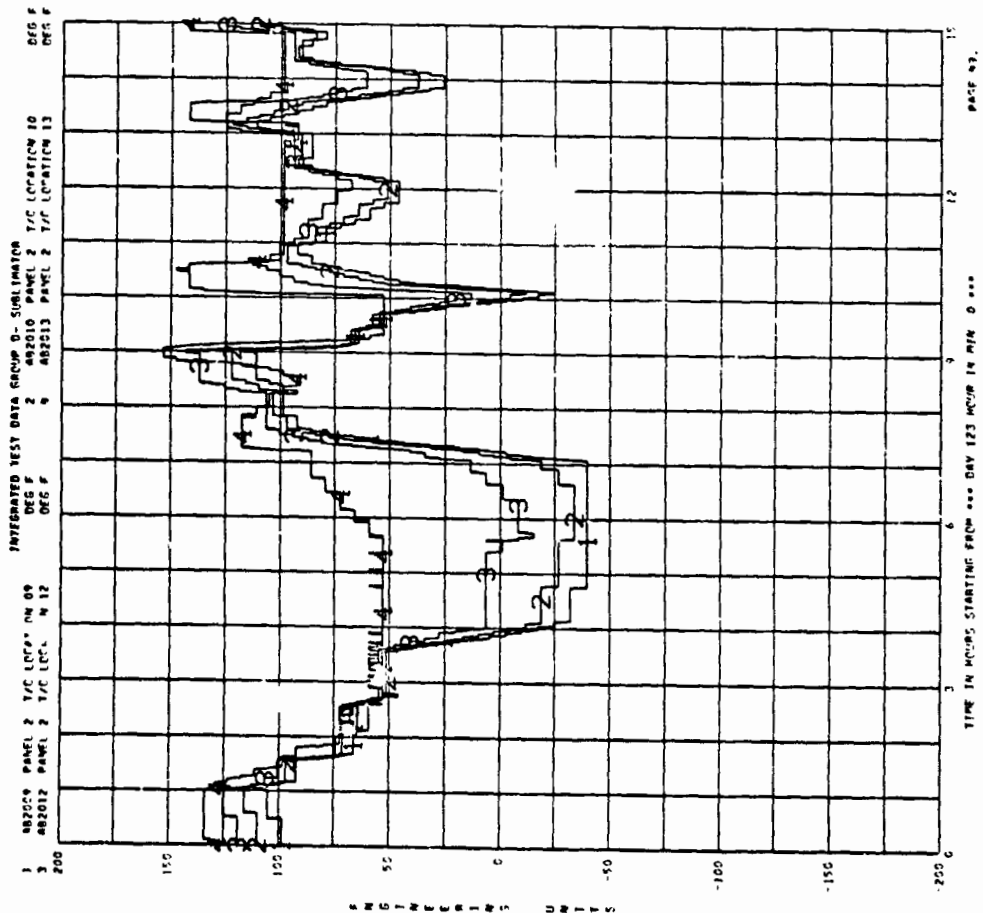
D-46



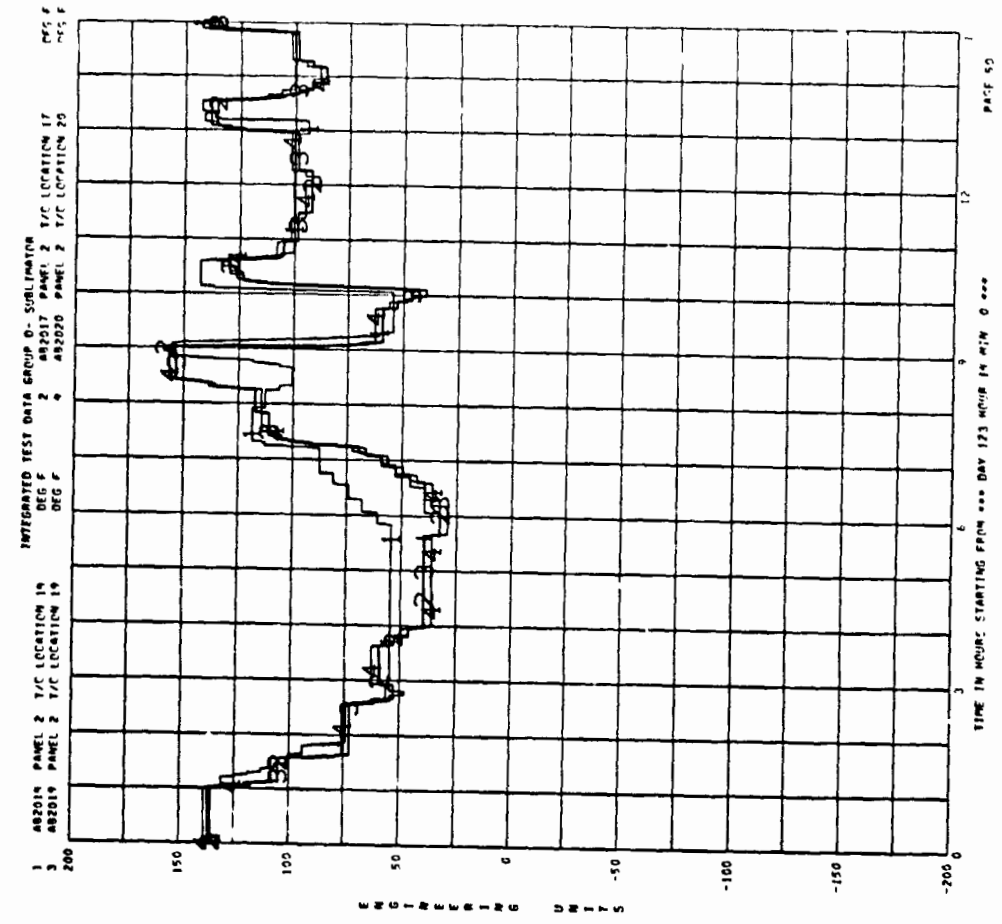
D-47



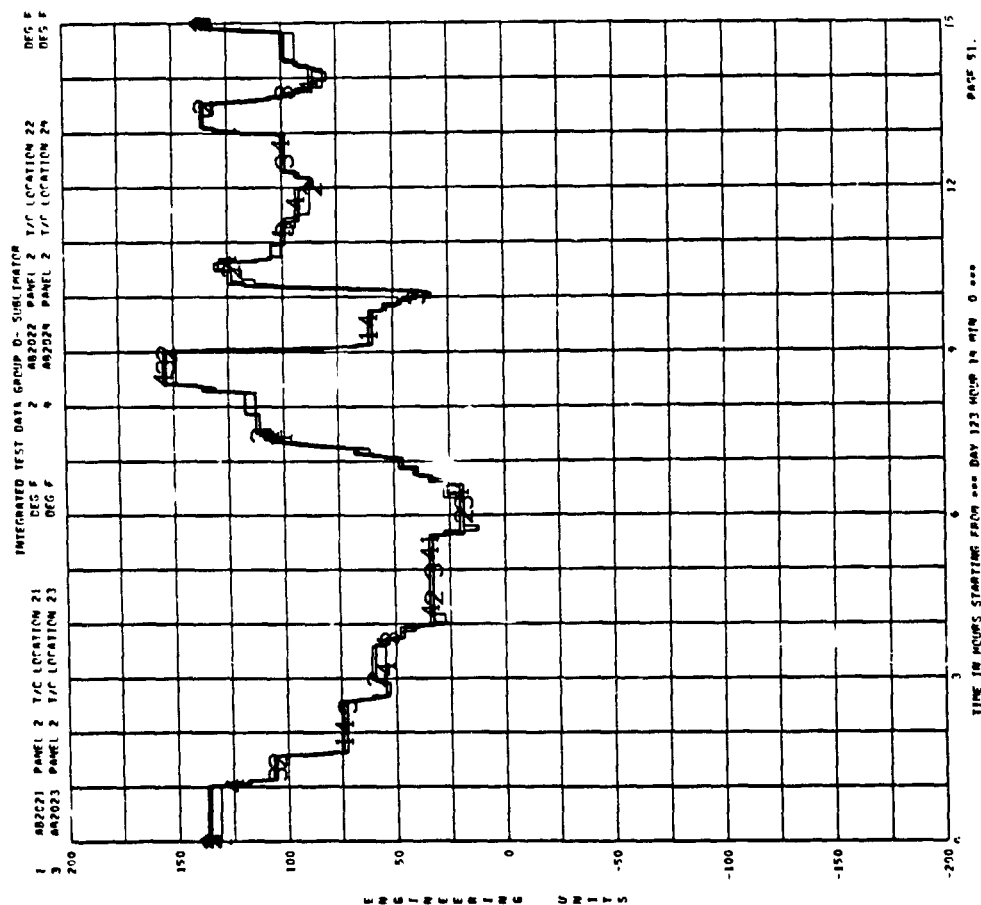
D-48



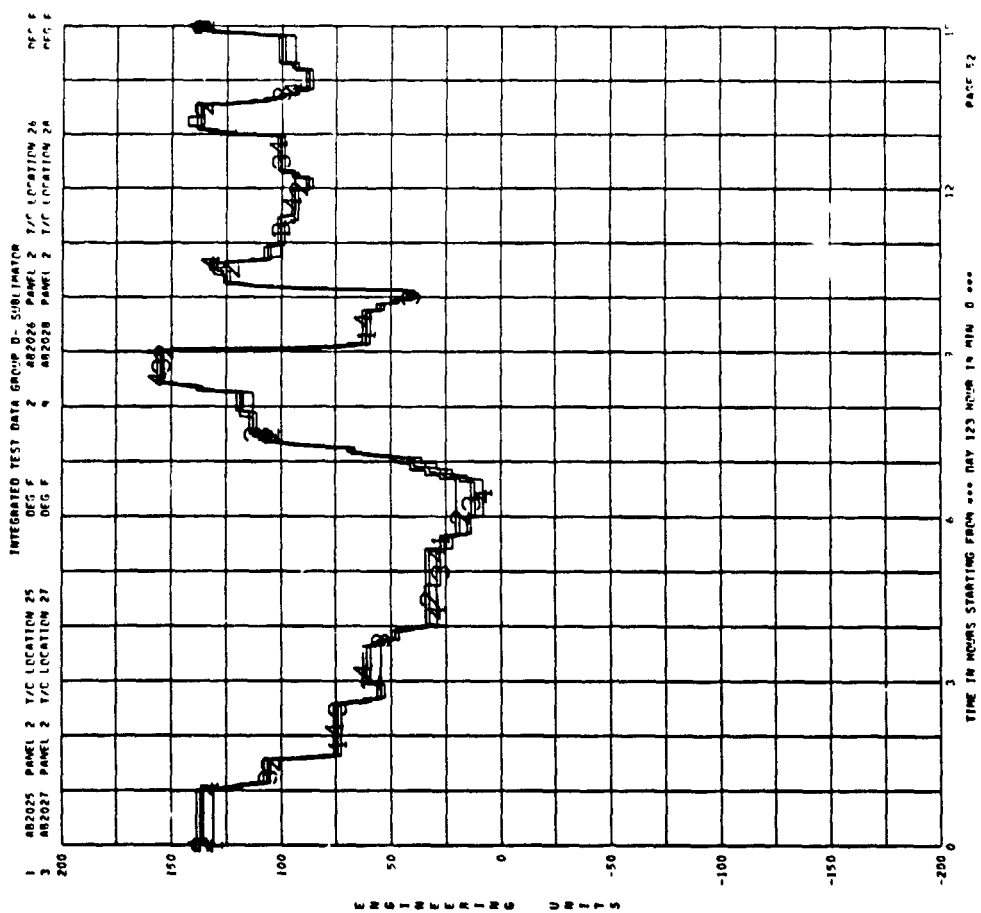
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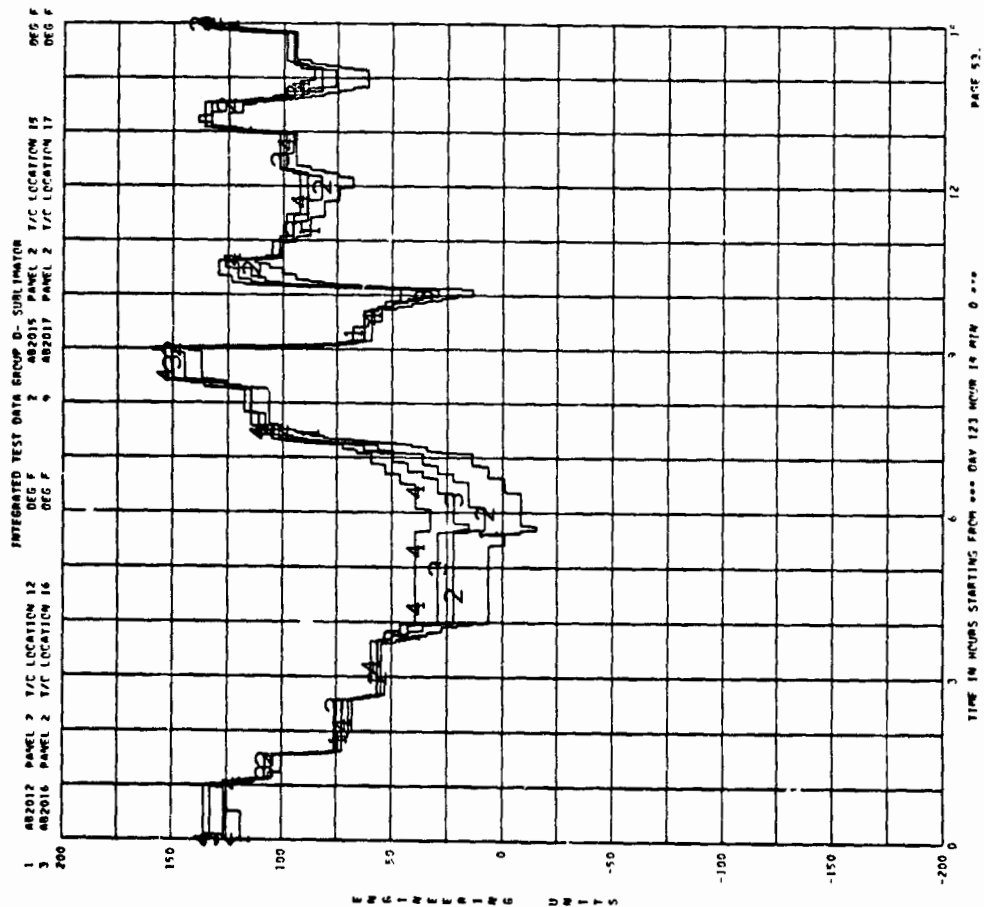
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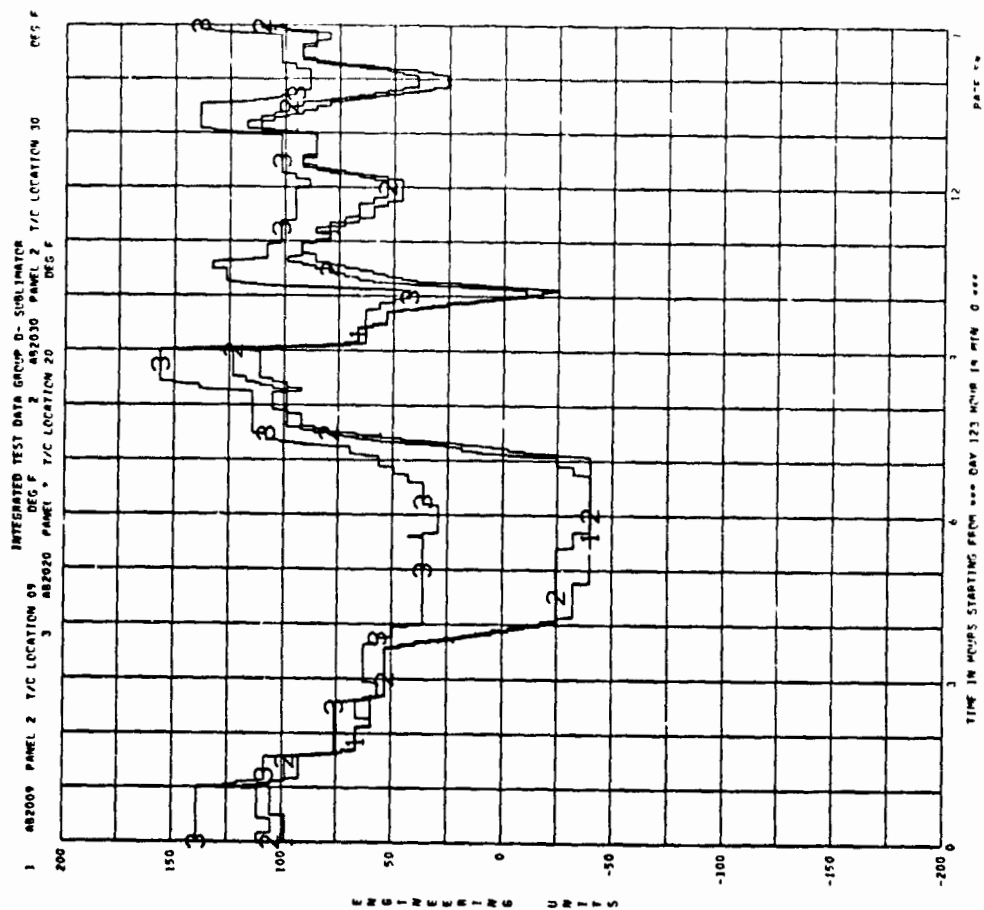
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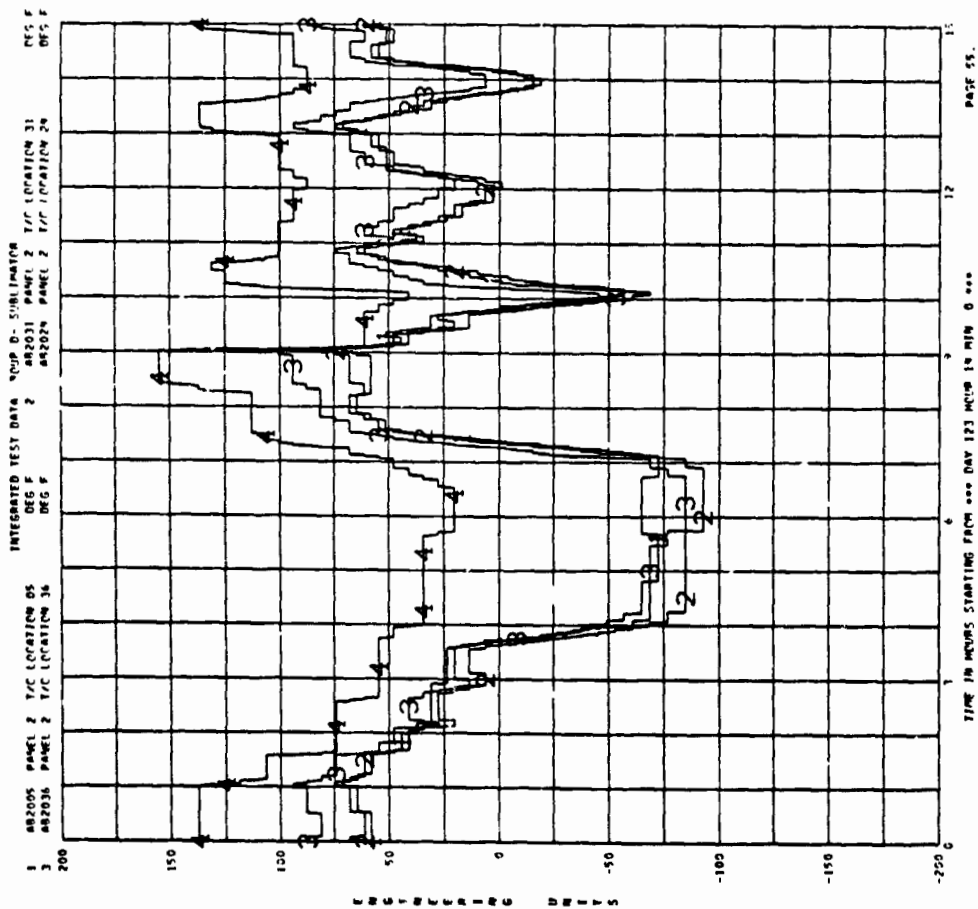
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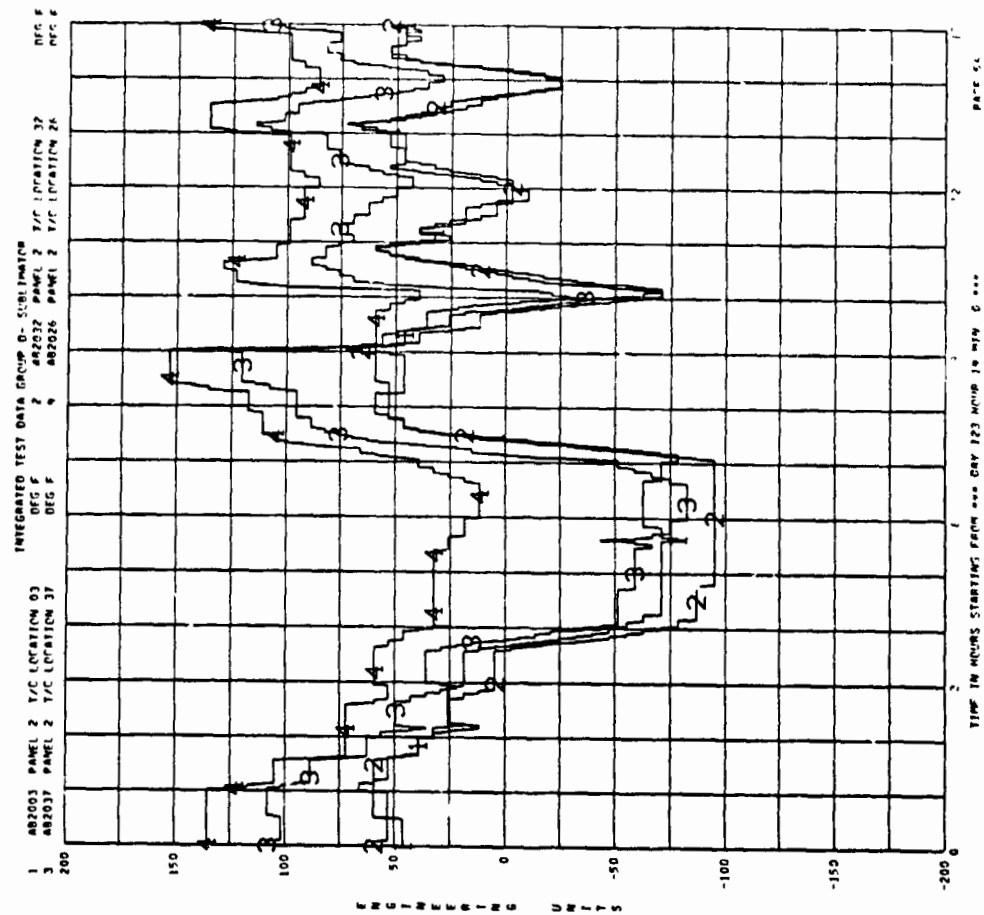
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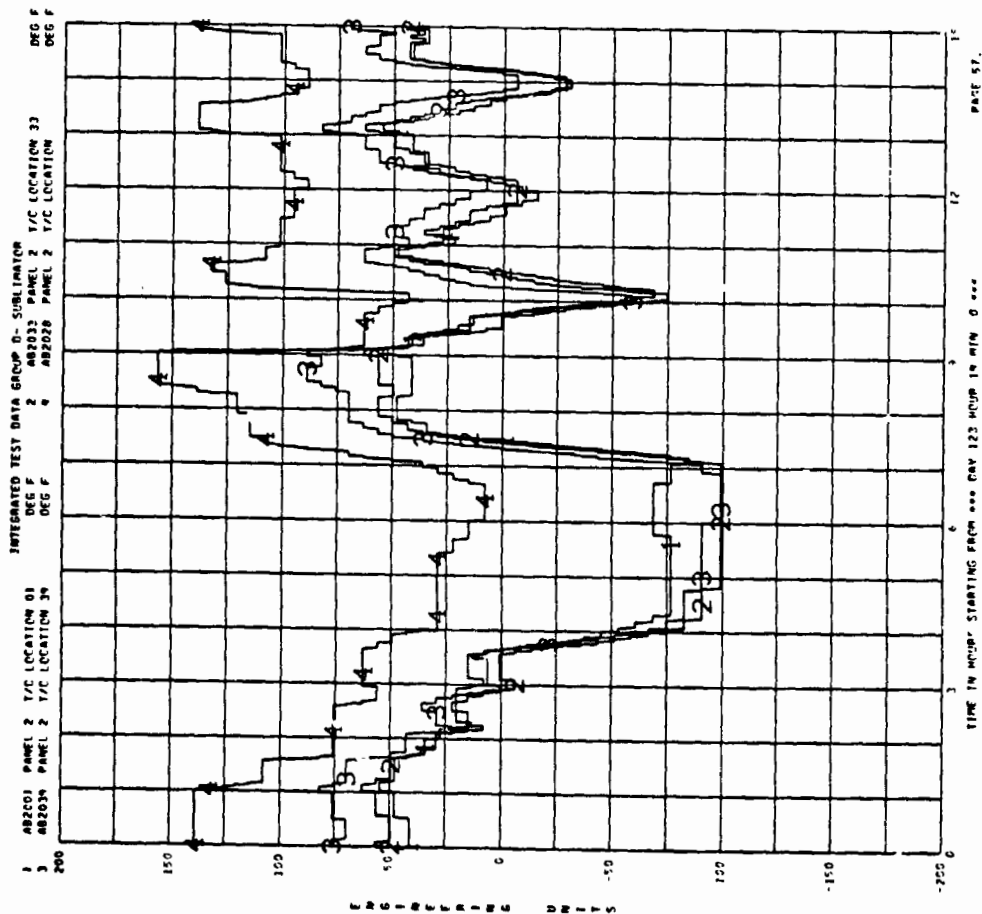
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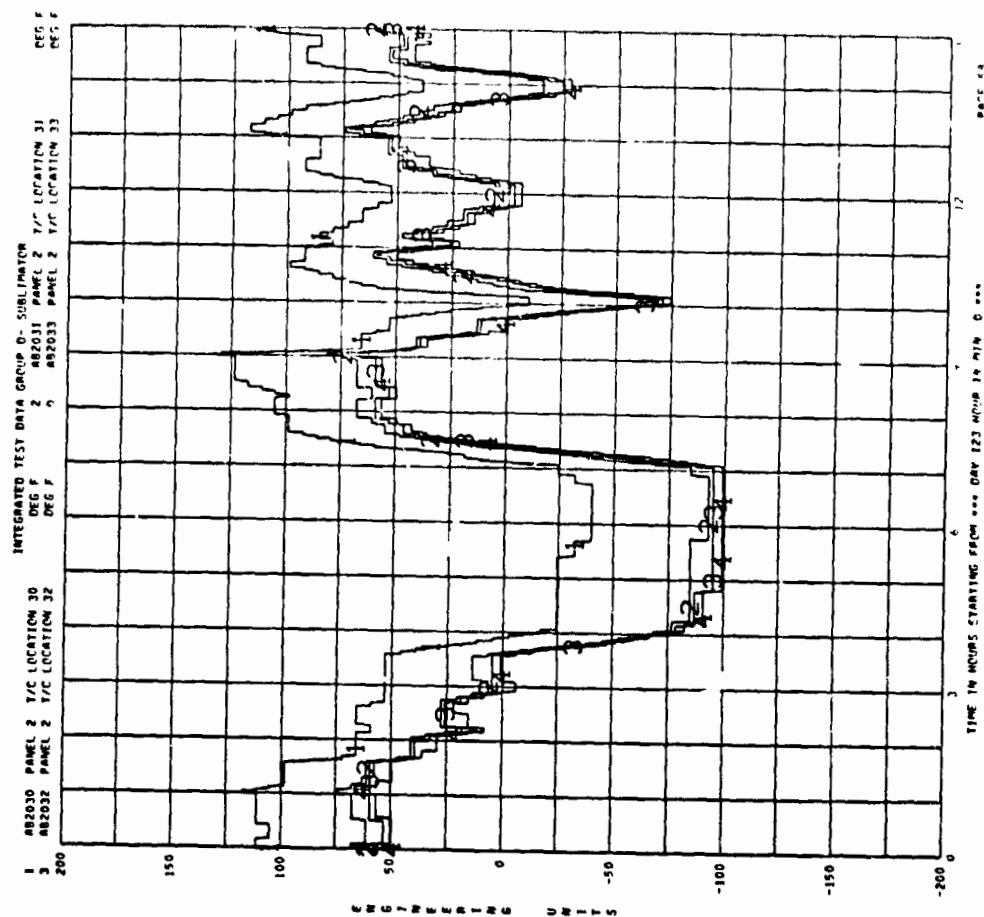
D-55



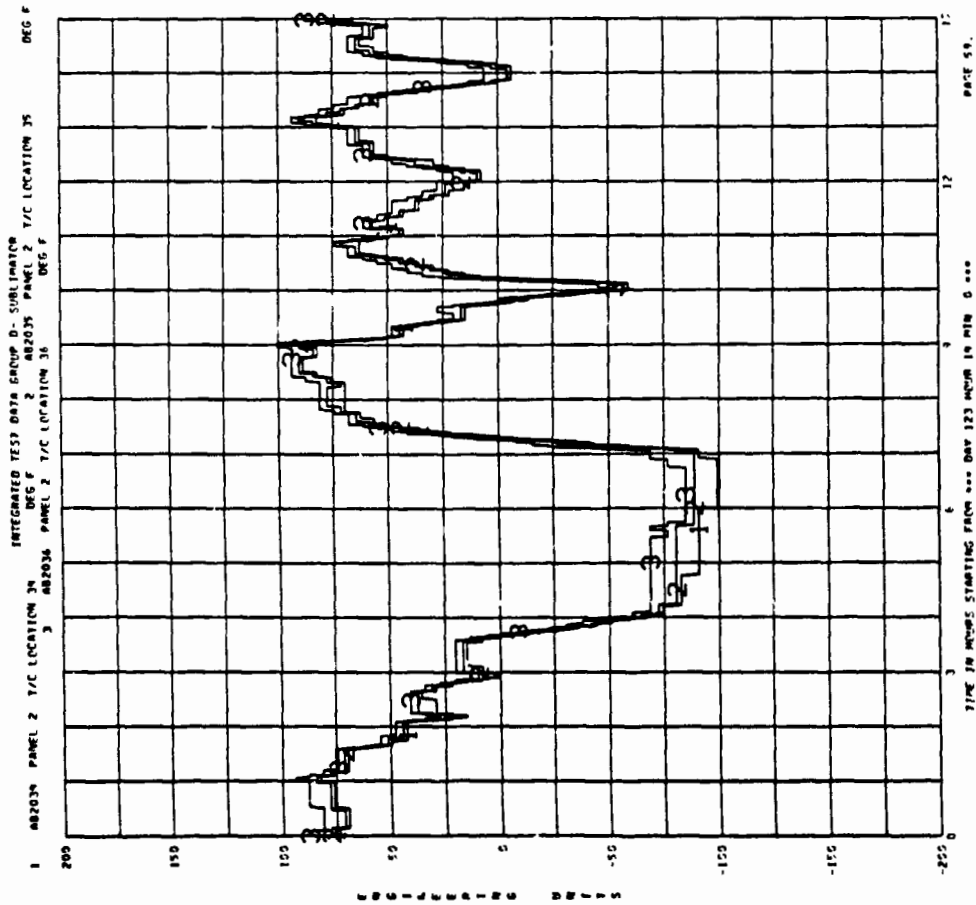
D-56



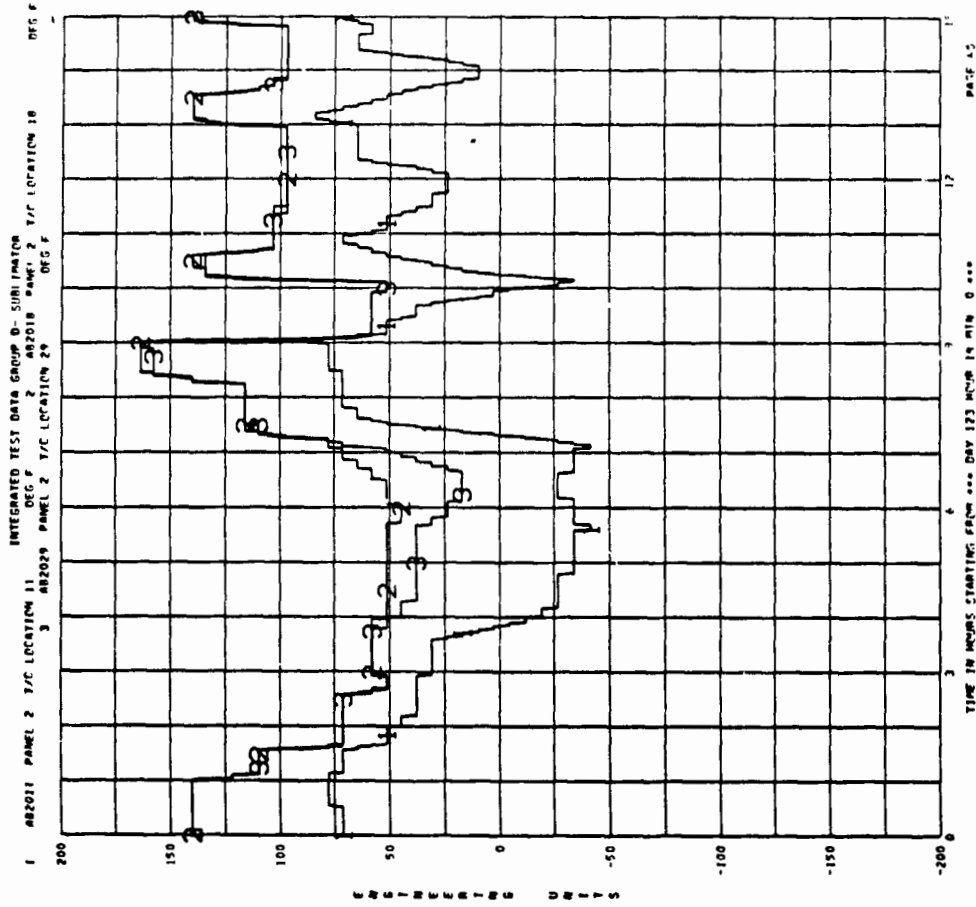
D-57



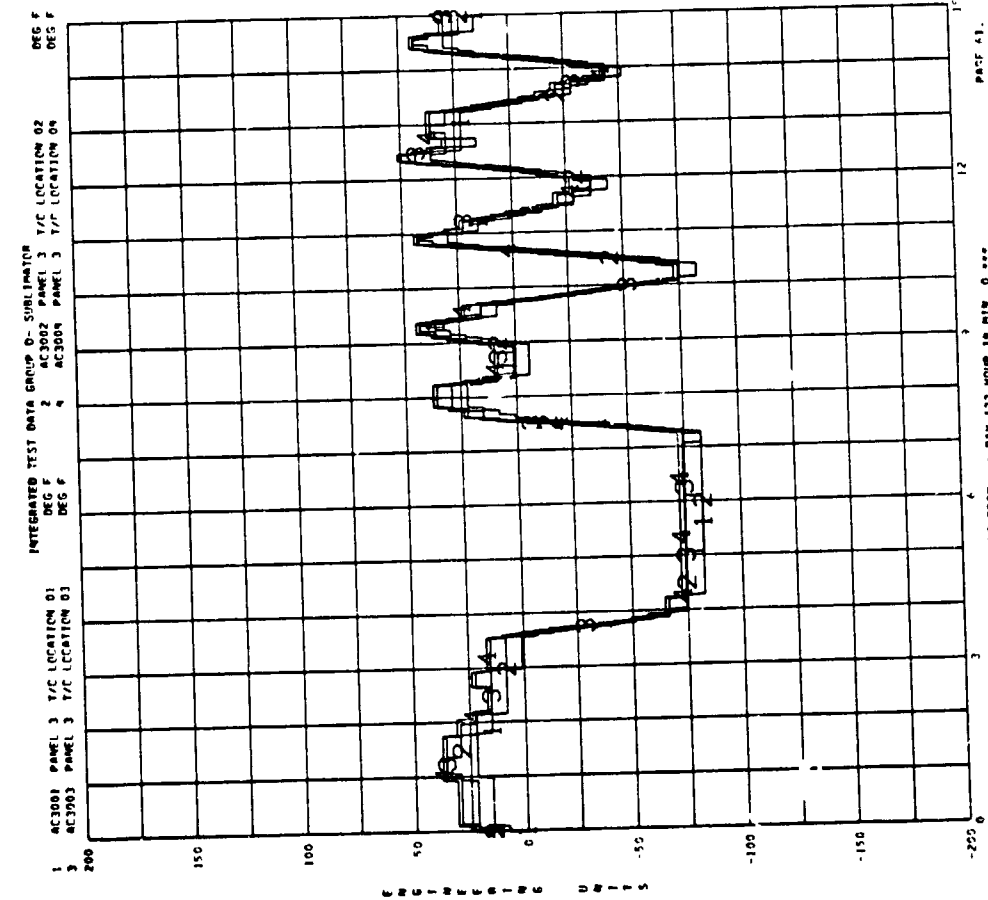
D-58



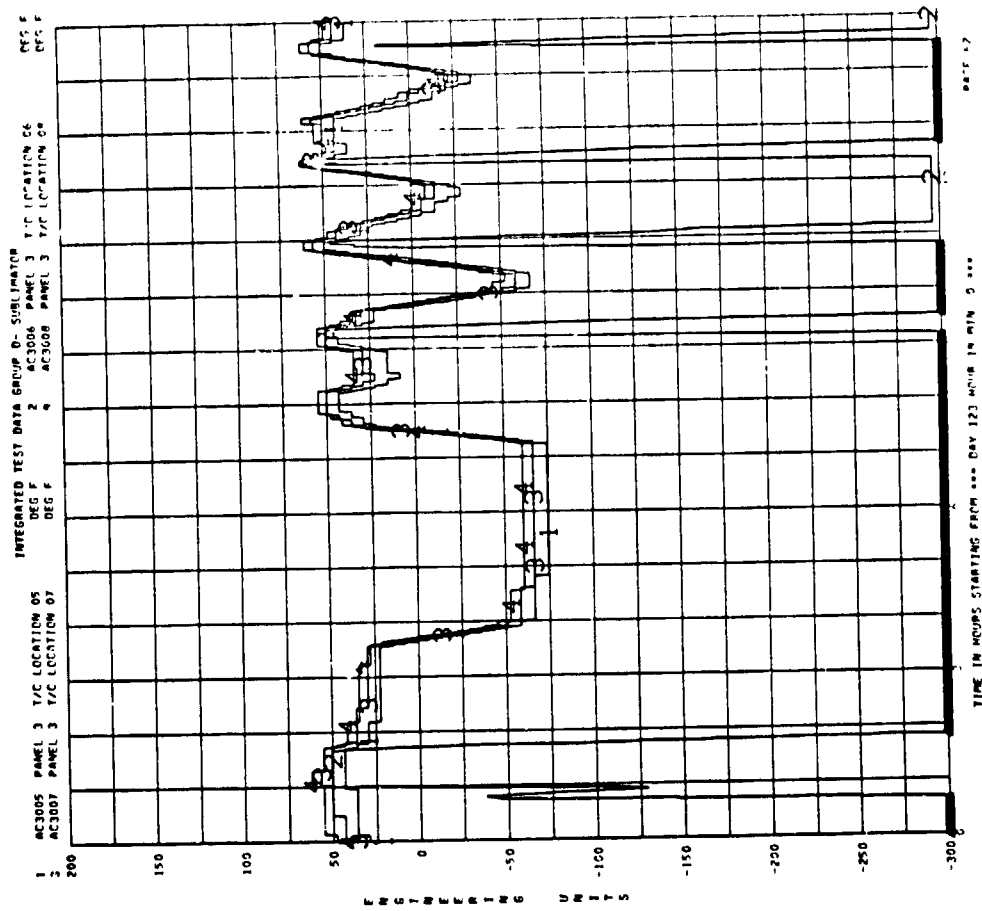
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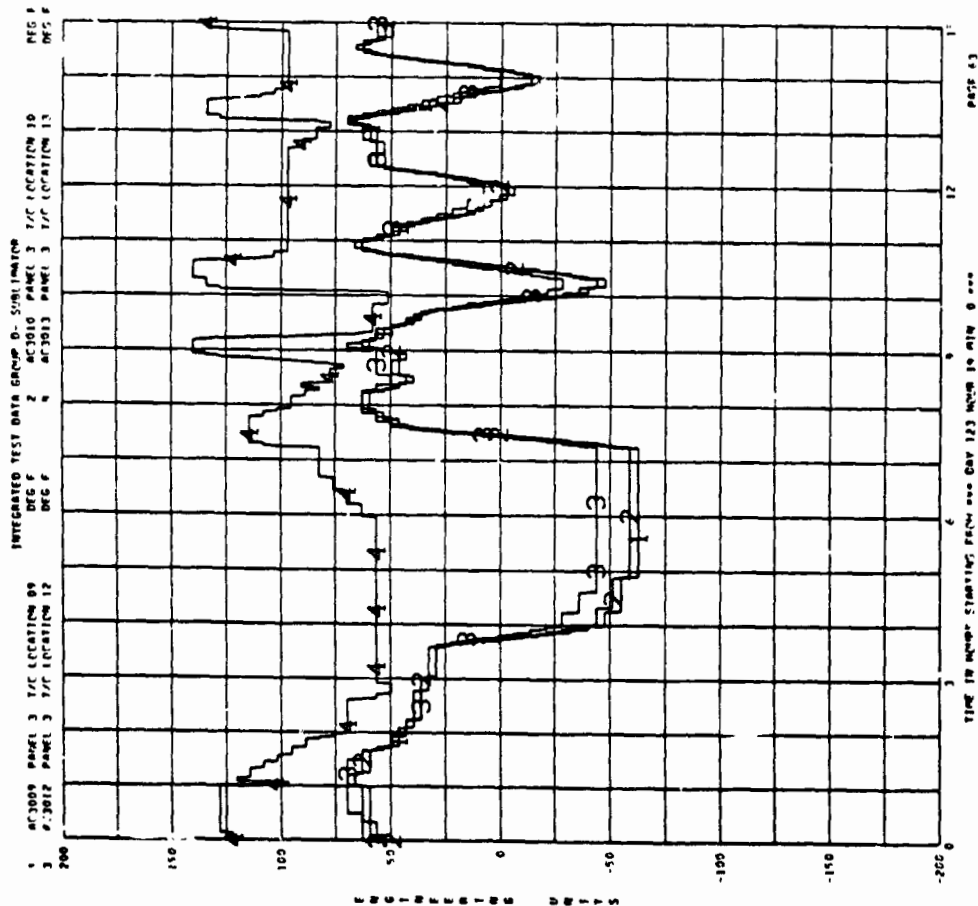
D-60



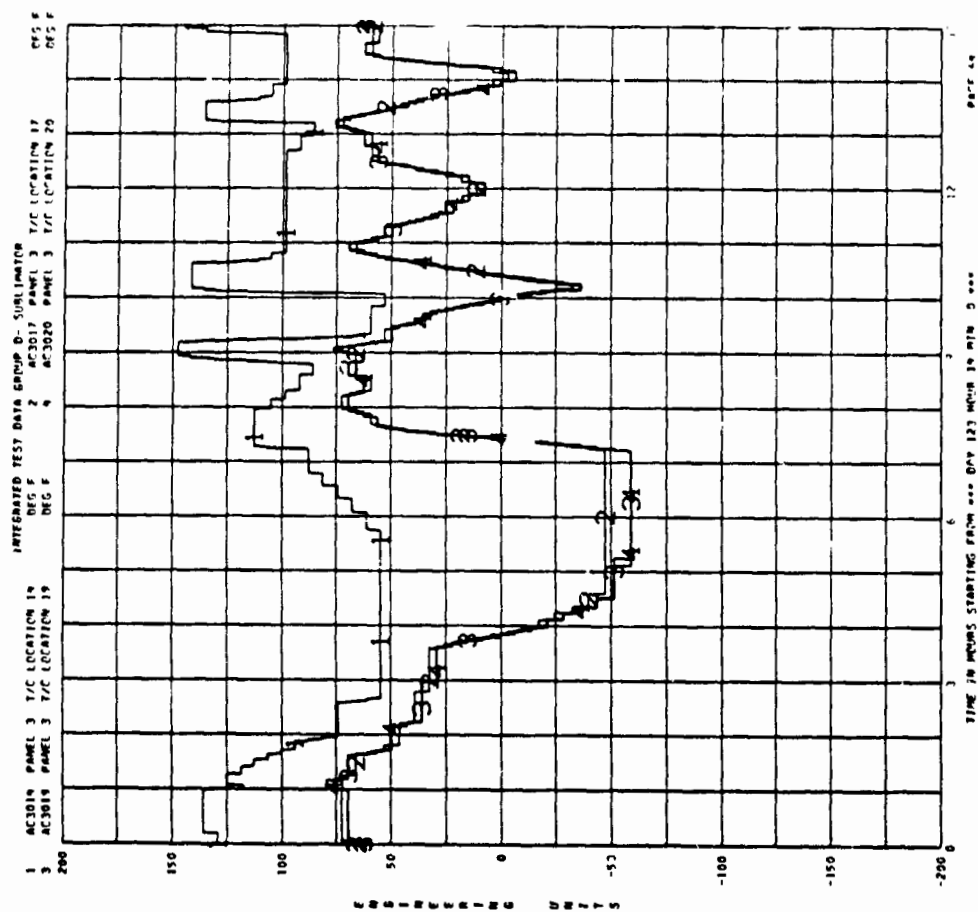
D-61



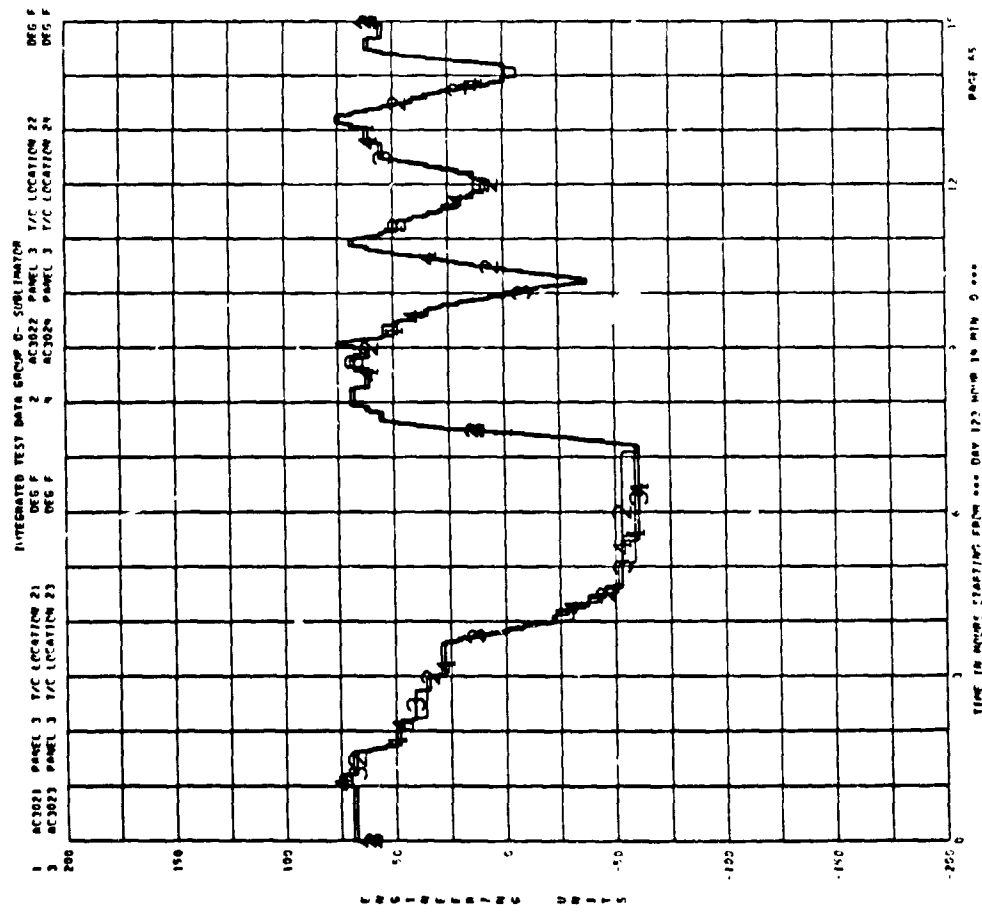
D-62



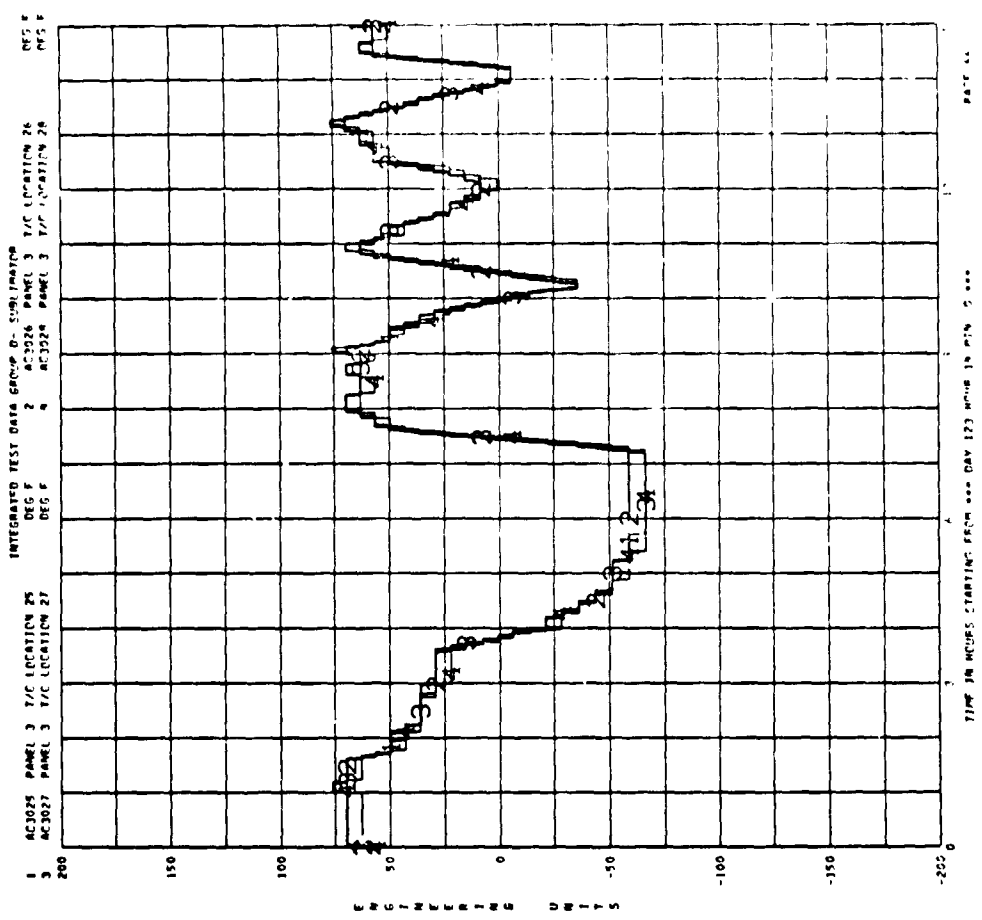
D-63



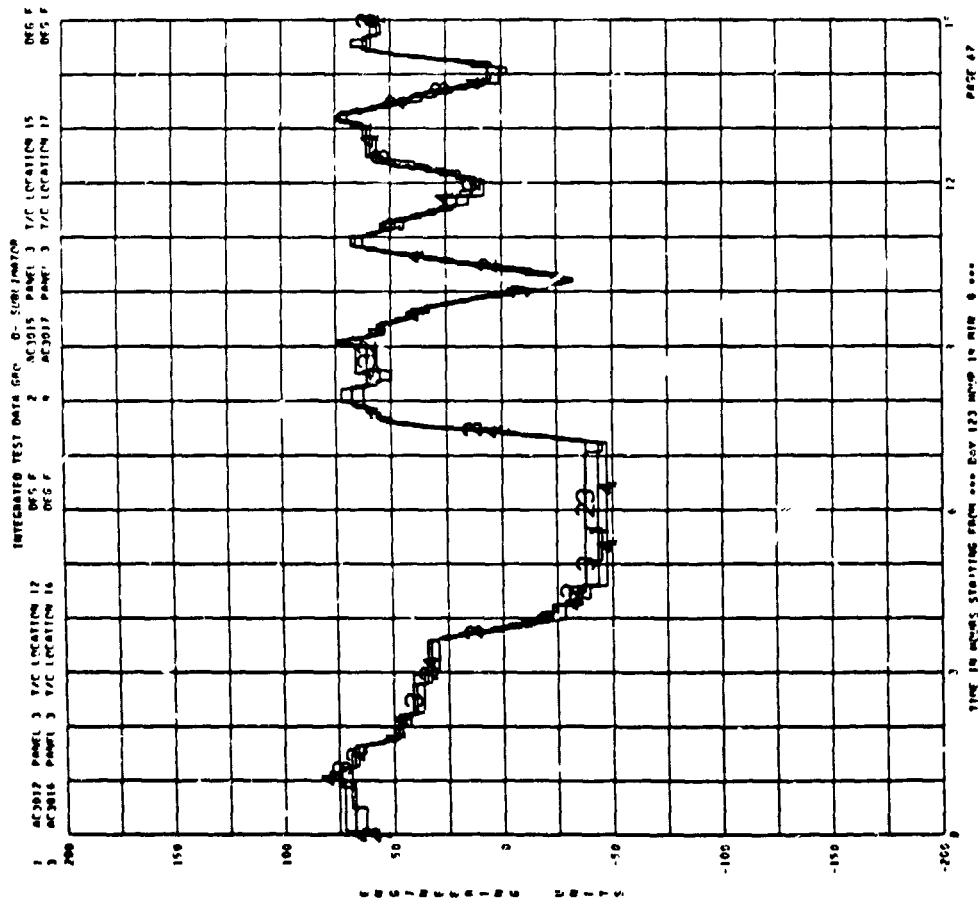
D-64



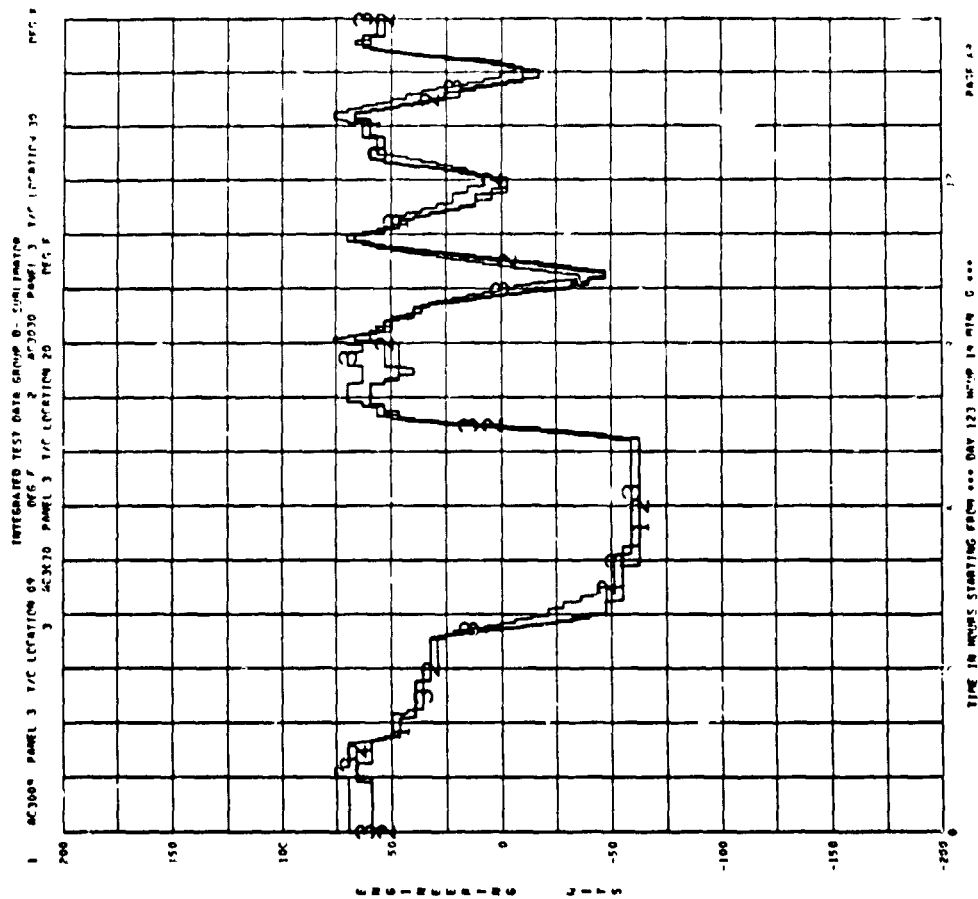
D-65



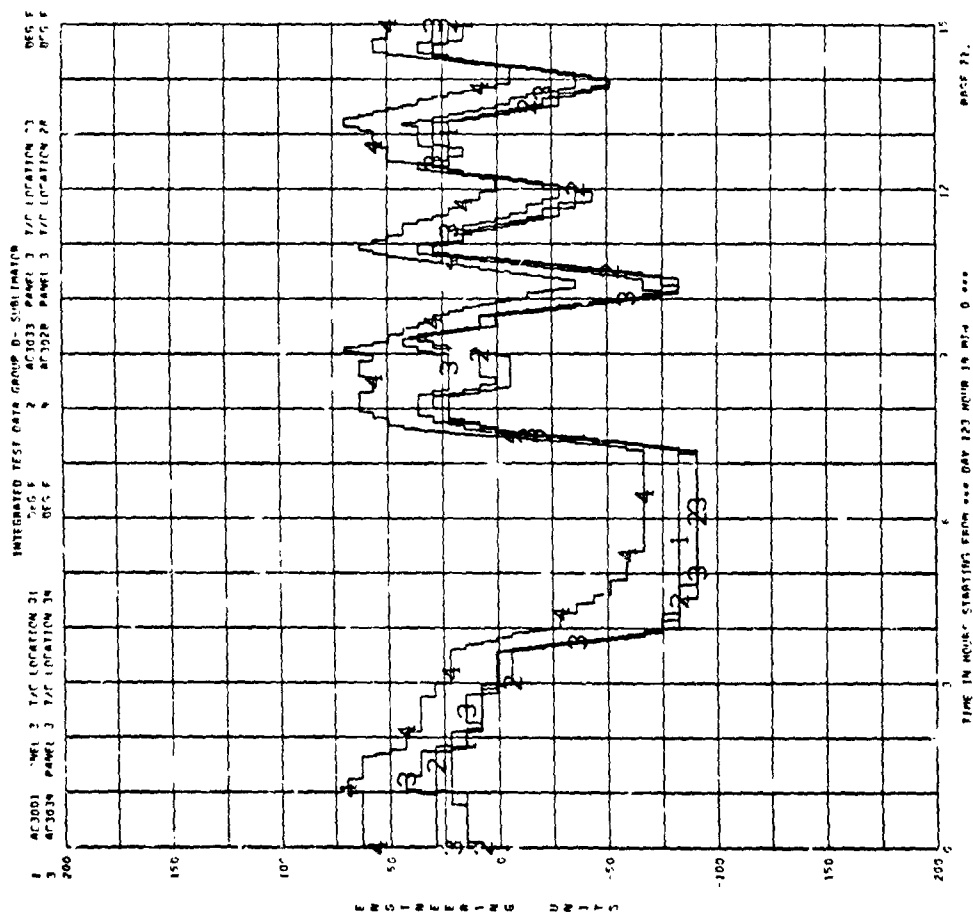
D-66



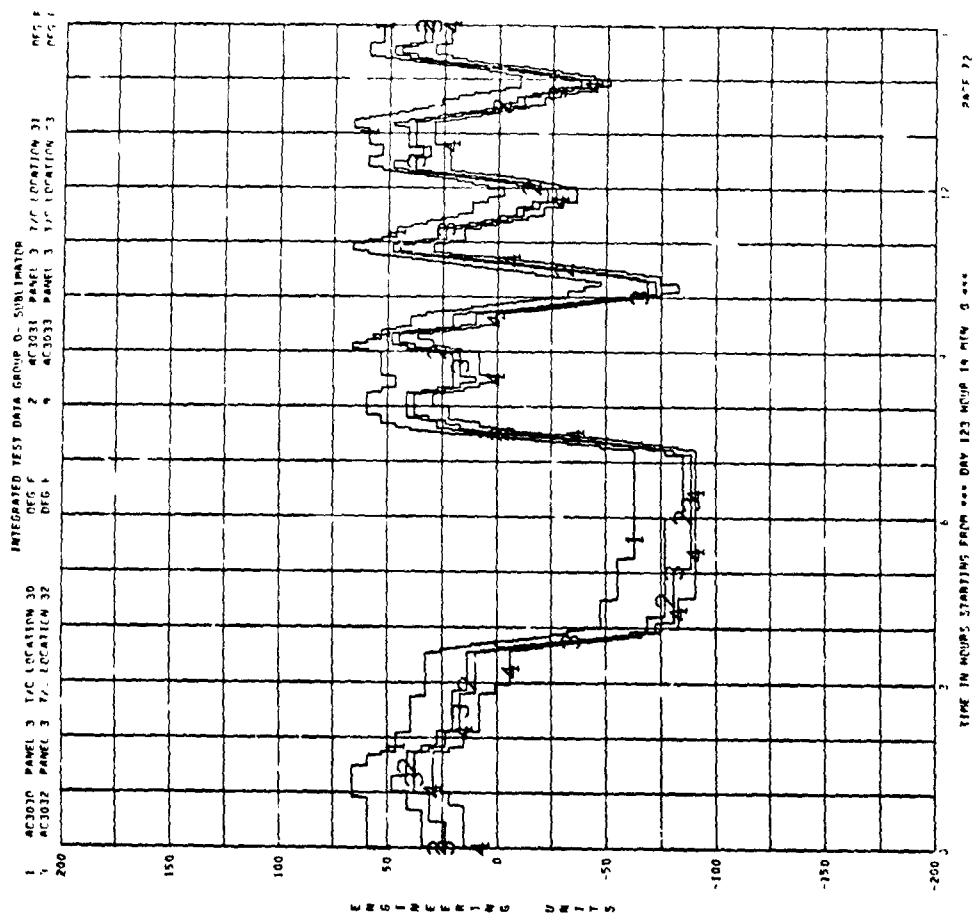
D-67



D-68

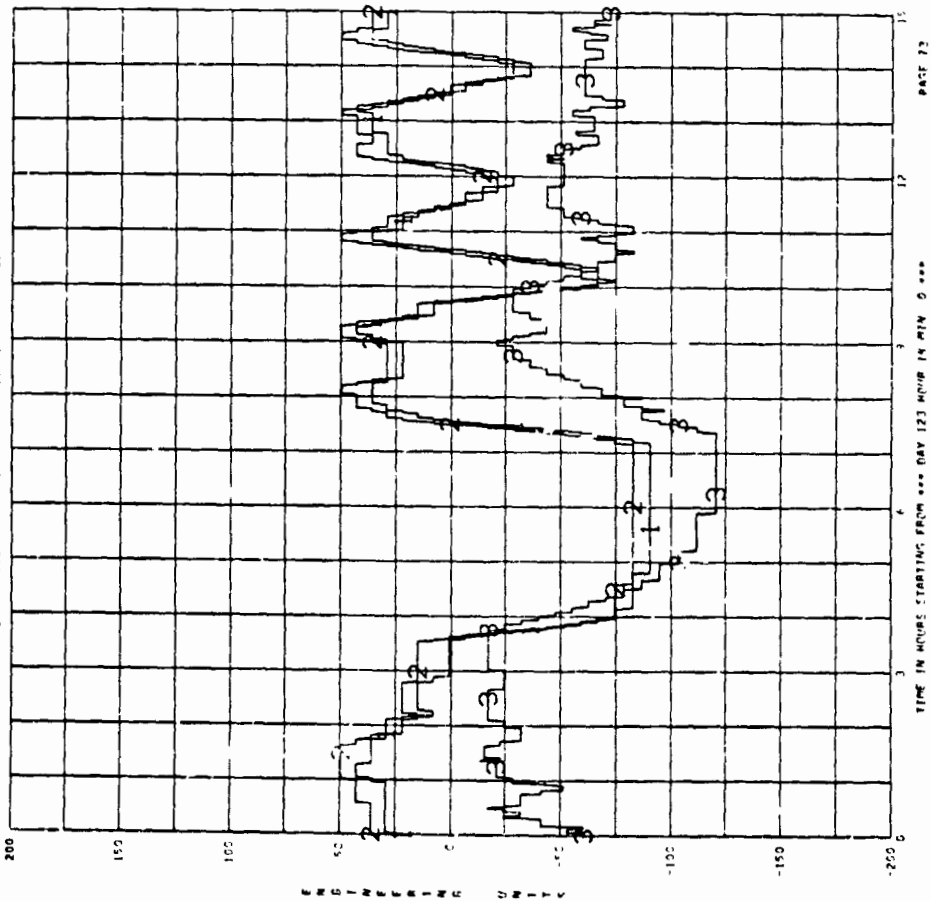


D-71



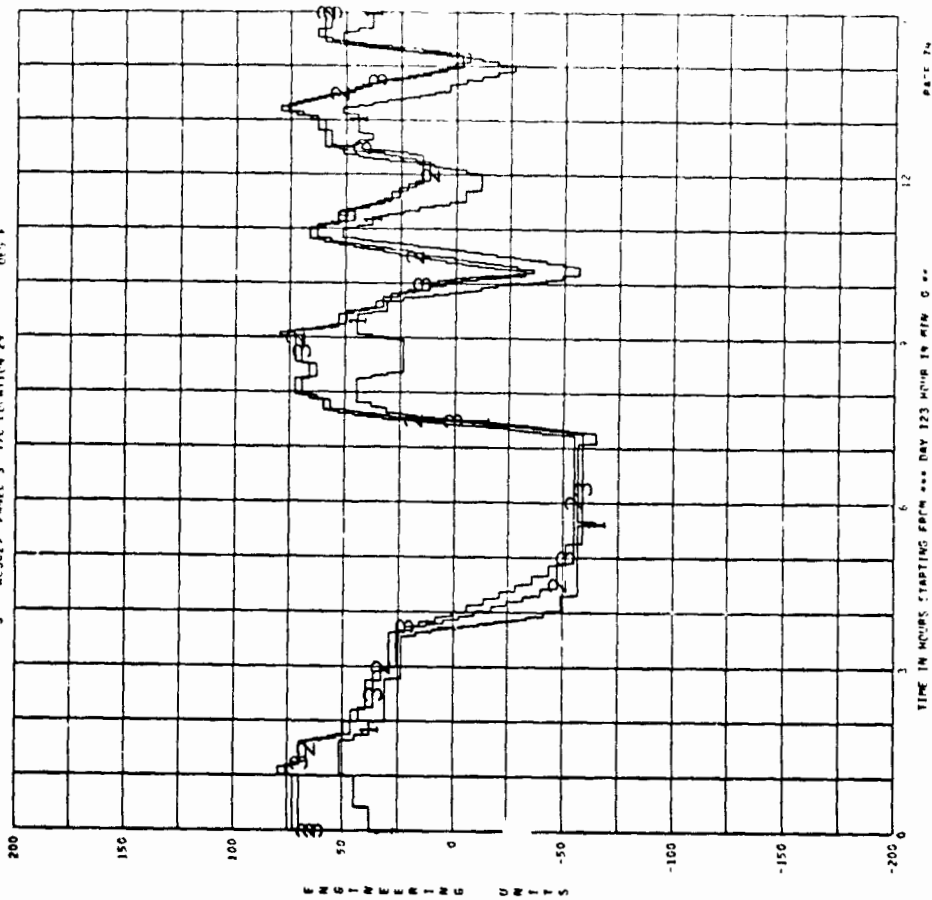
D-72

1 AC3034 PANEL 3 T/C LOCATION 34 DEG F
 2 AC3035 PANEL 3 T/C LOCATION 35 DEG F
 3 AC3036 PANEL 3 T/C LOCATION 36 DEG F

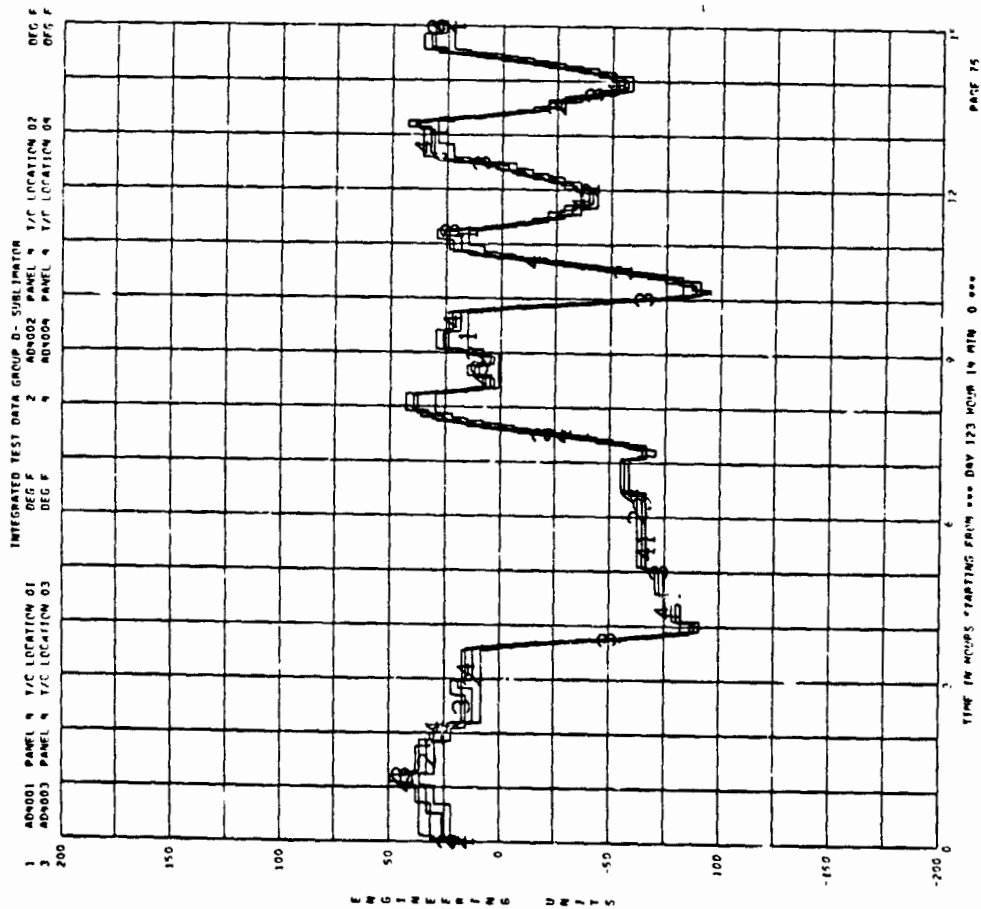


D-73

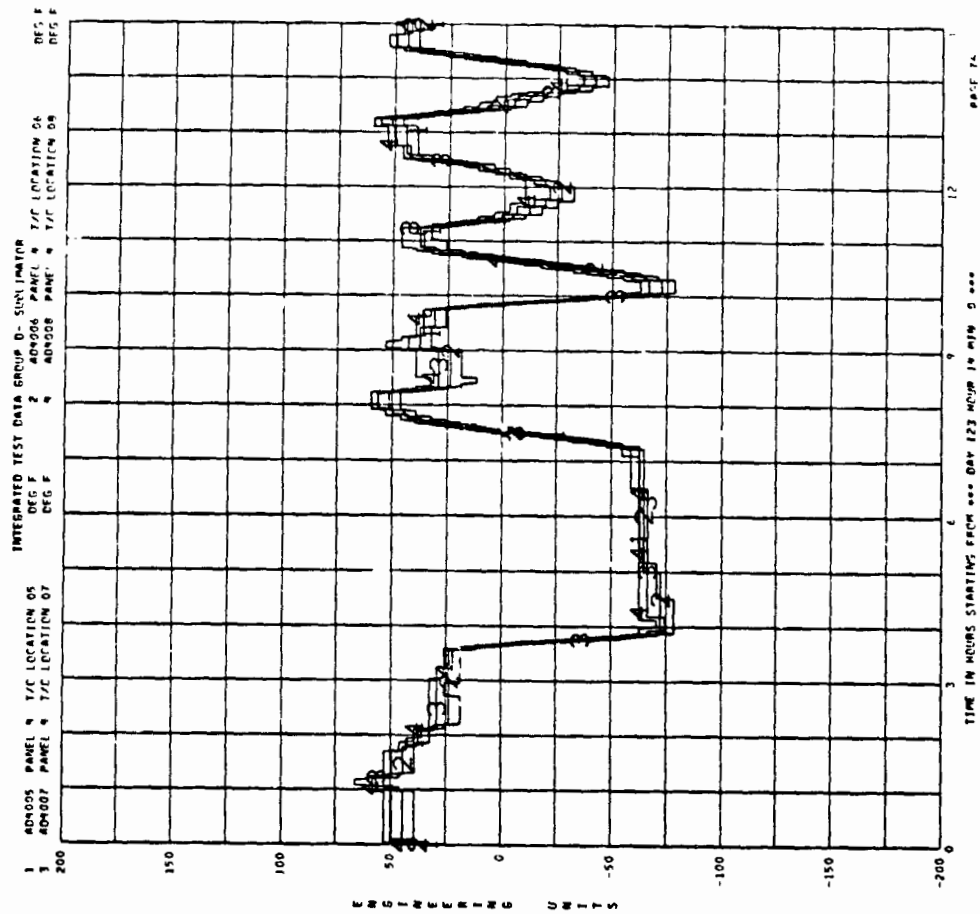
1 AC3011 PANEL 3 T/C LOCATION 11 DEG F
 2 AC3012 PANEL 3 T/C LOCATION 12 DEG F
 3 AC3029 PANEL 3 T/C LOCATION 29 DEG F



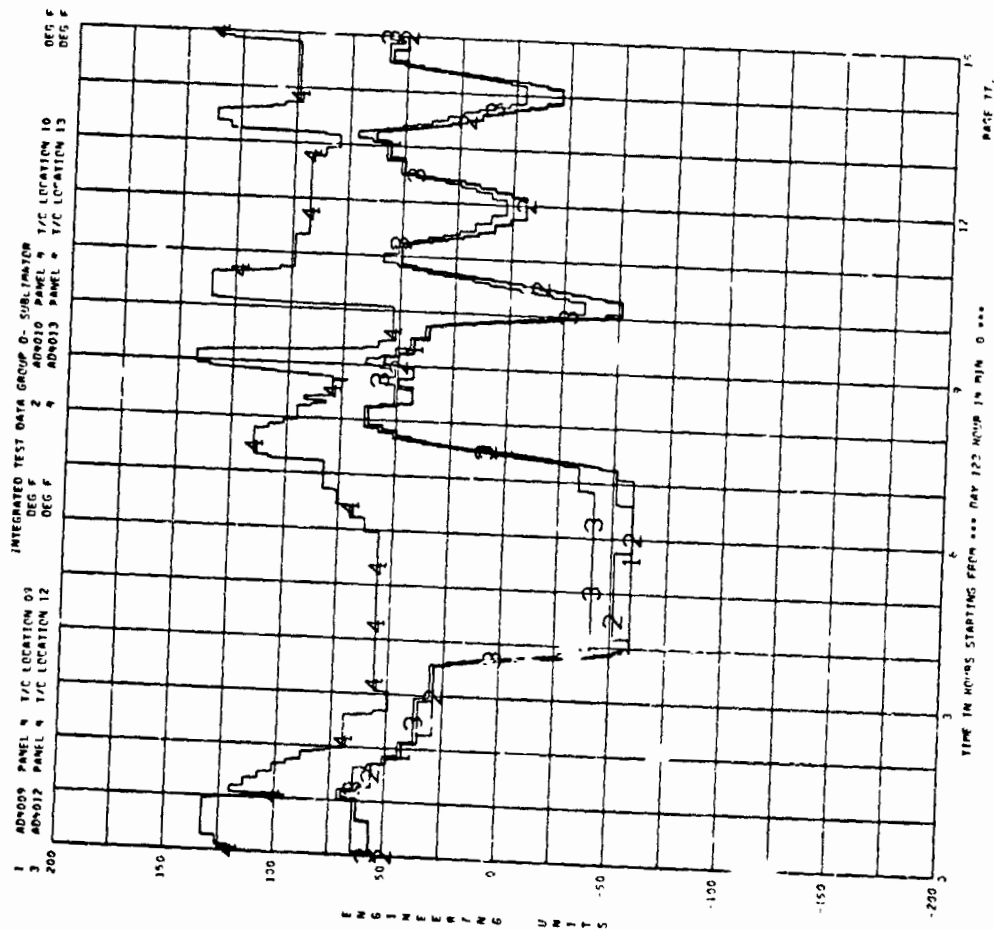
D-74



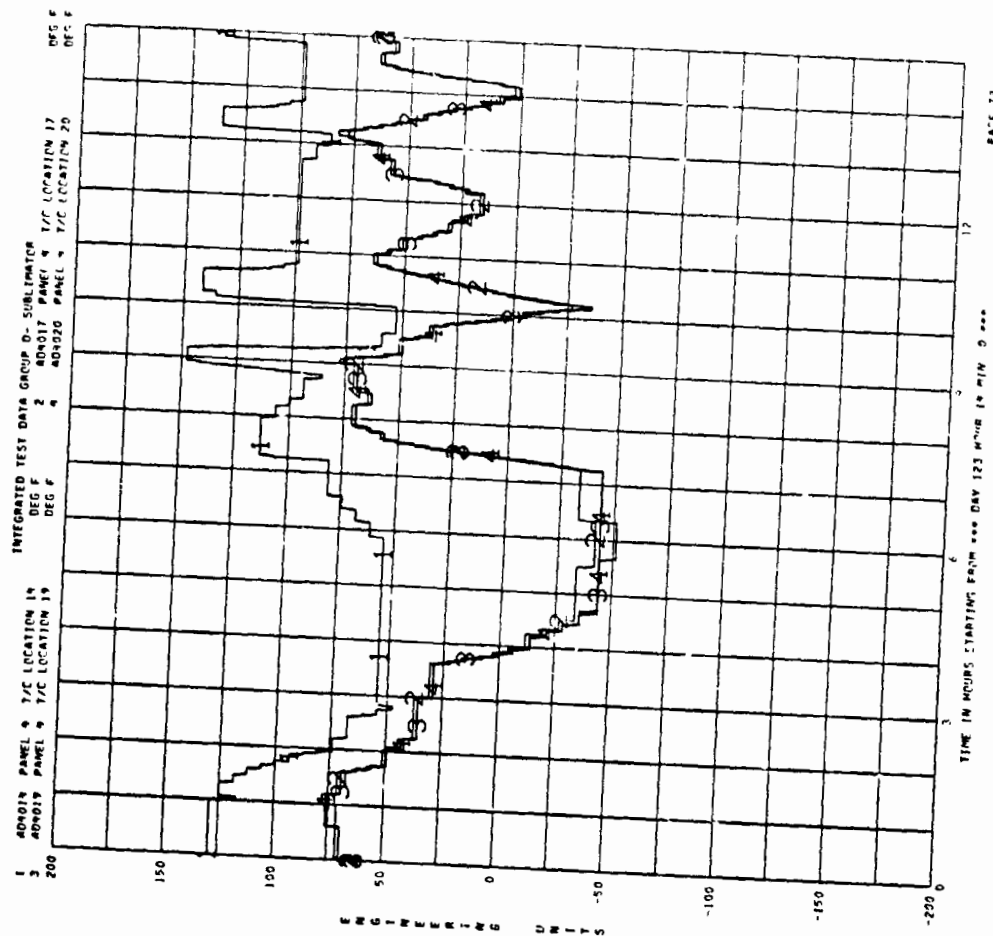
D-75



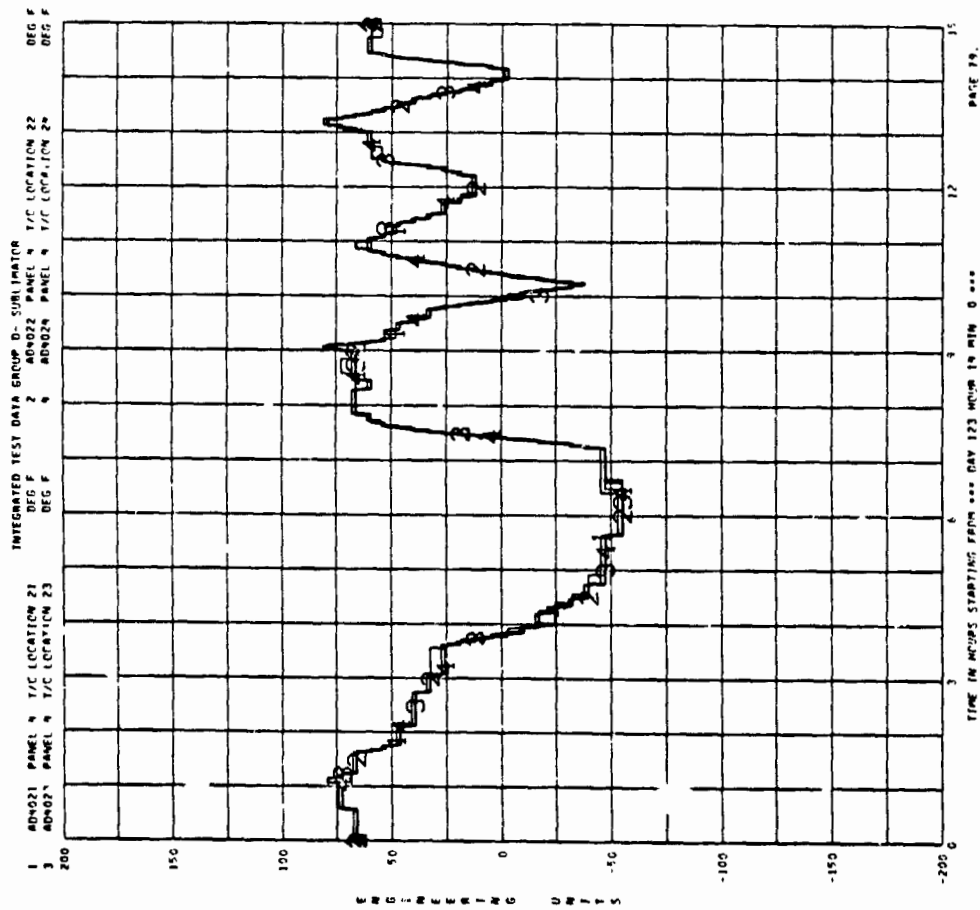
D-76



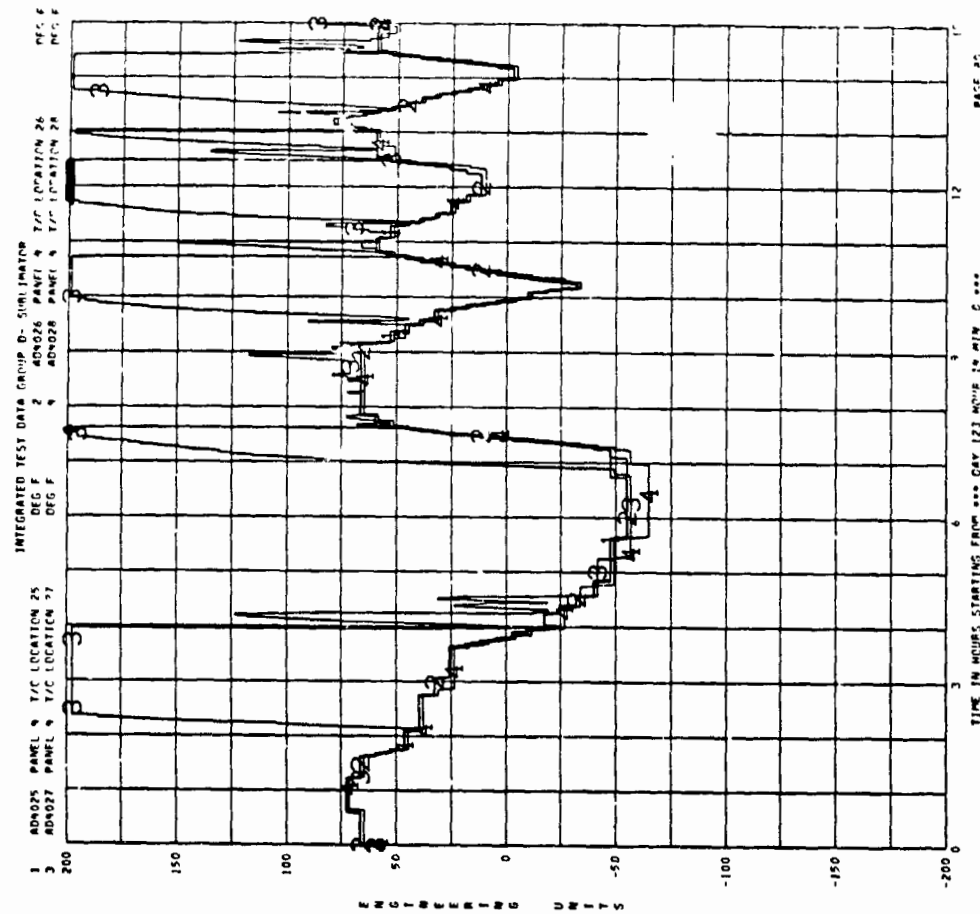
D-77



D-78

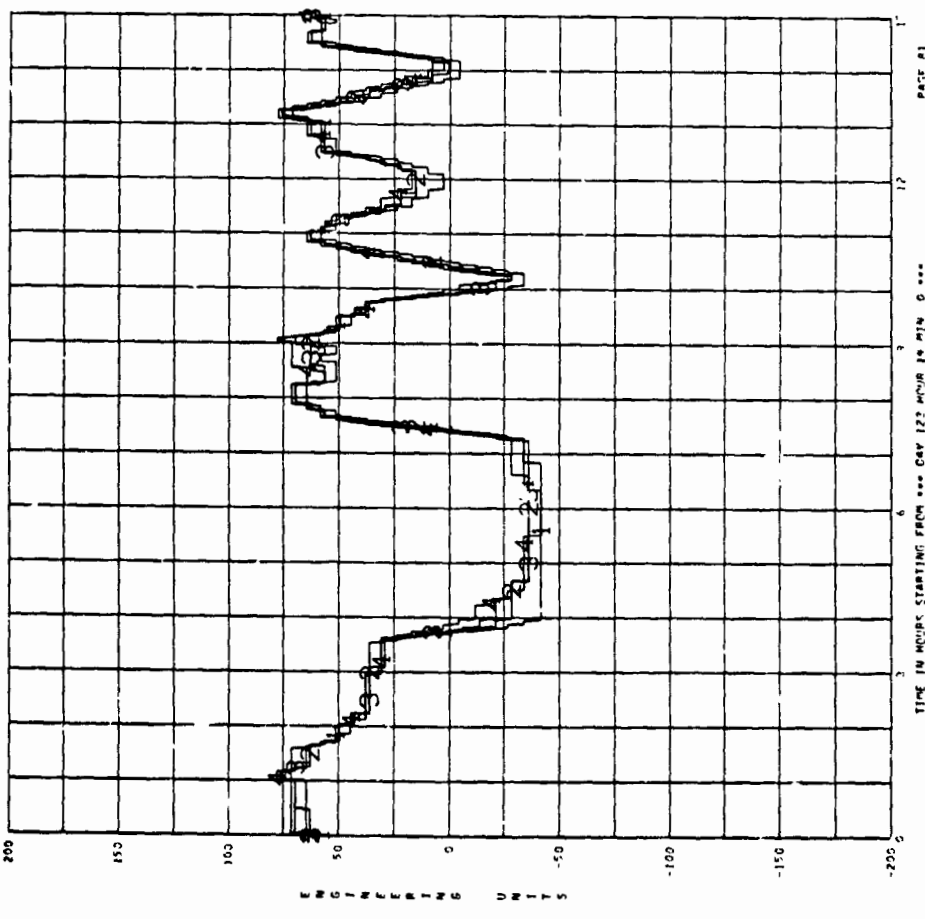


D-79



D-80

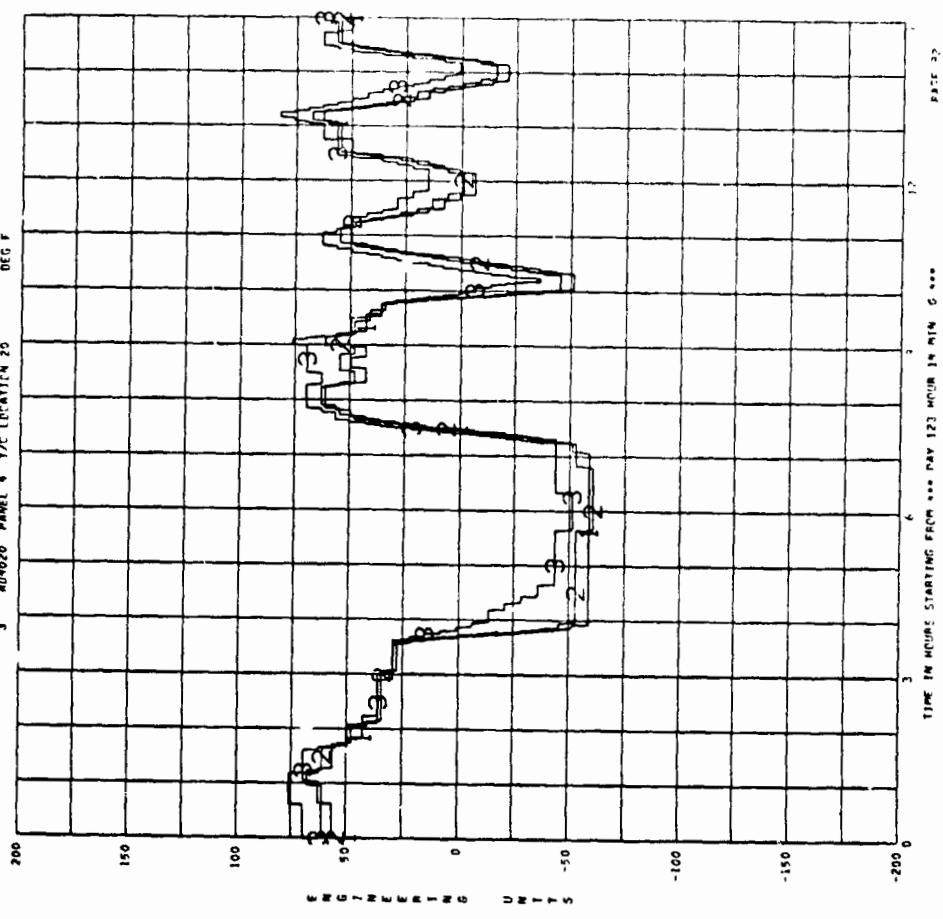
INTEGRATED TEST DATA GROUP D- SUBIMATOR
 1 AD-0012 PANEL 4 T/C LOCATION 32 DEG F
 2 AD-0016 PANEL 4 T/C LOCATION 36 DEG F
 3 AD-0017 PANEL 4 T/C LOCATION 17 DEG F



D-81

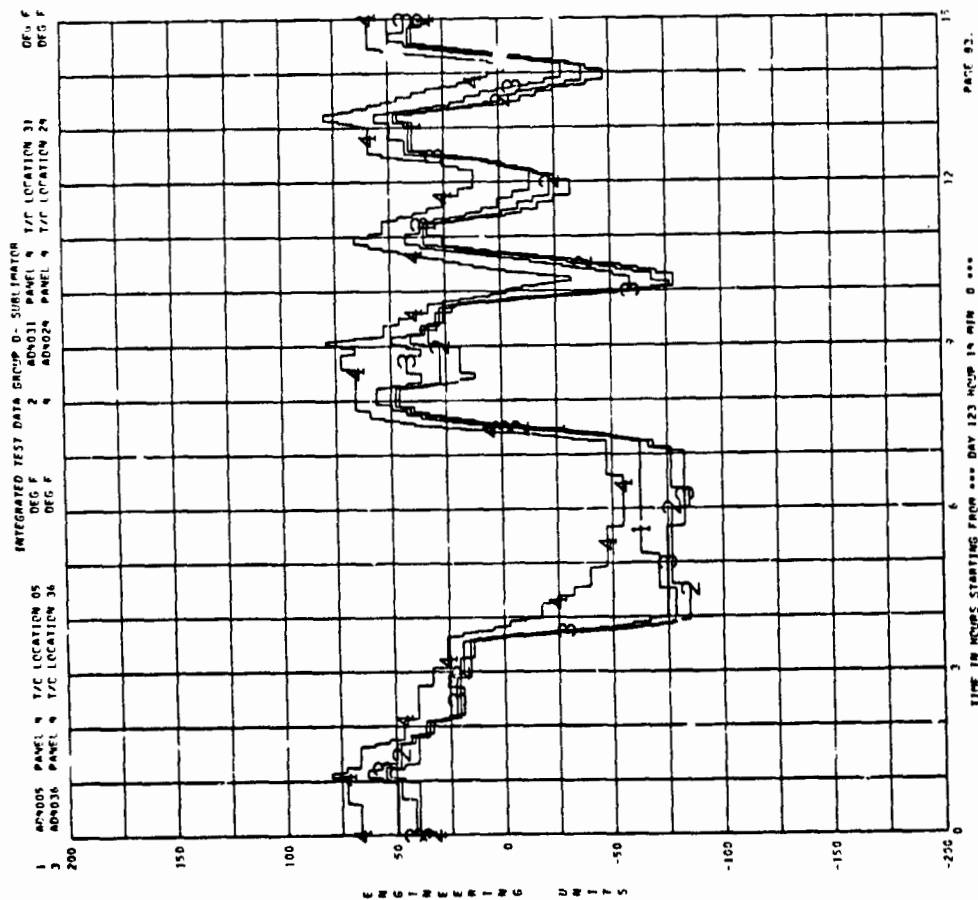
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INTEGRATED TEST DATA GROUP D- SUBIMATOR
 1 AD-0009 PANEL 4 T/C LOCATION 09 DEG F
 2 AD-0030 PANEL 4 T/C LOCATION 10 DEG F
 3 AD-0020 PANEL 4 T/C LOCATION 20 DEG F

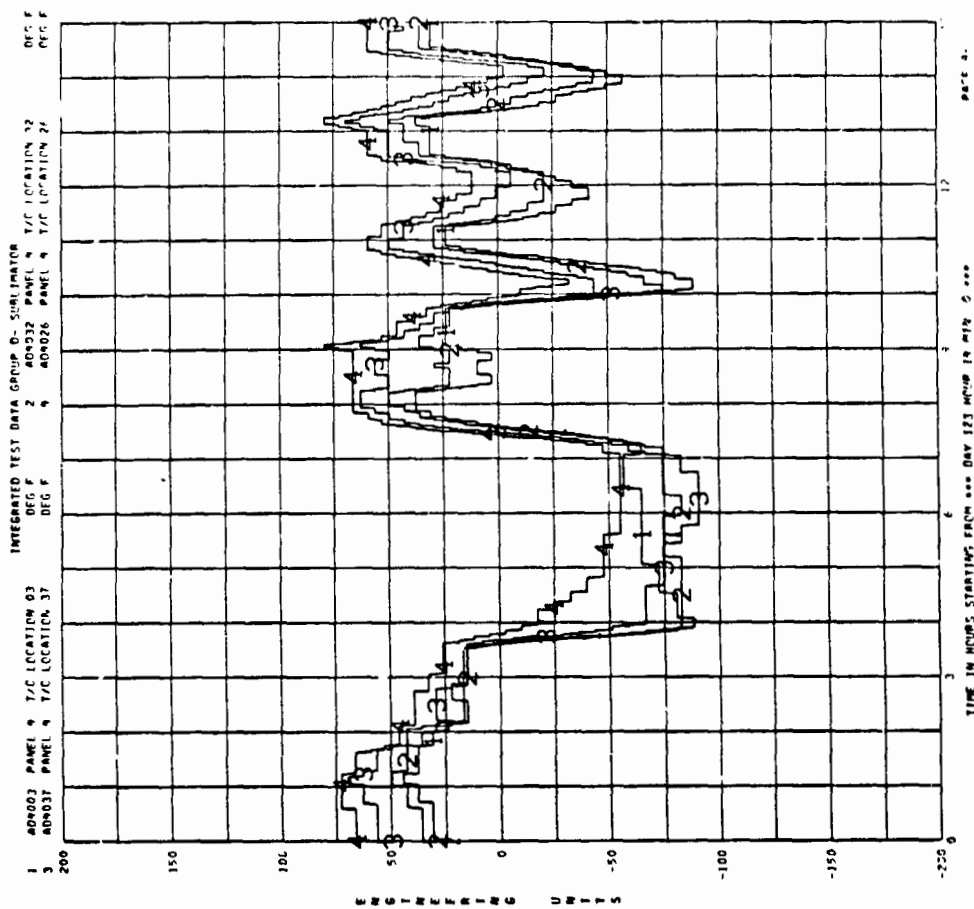


D-82

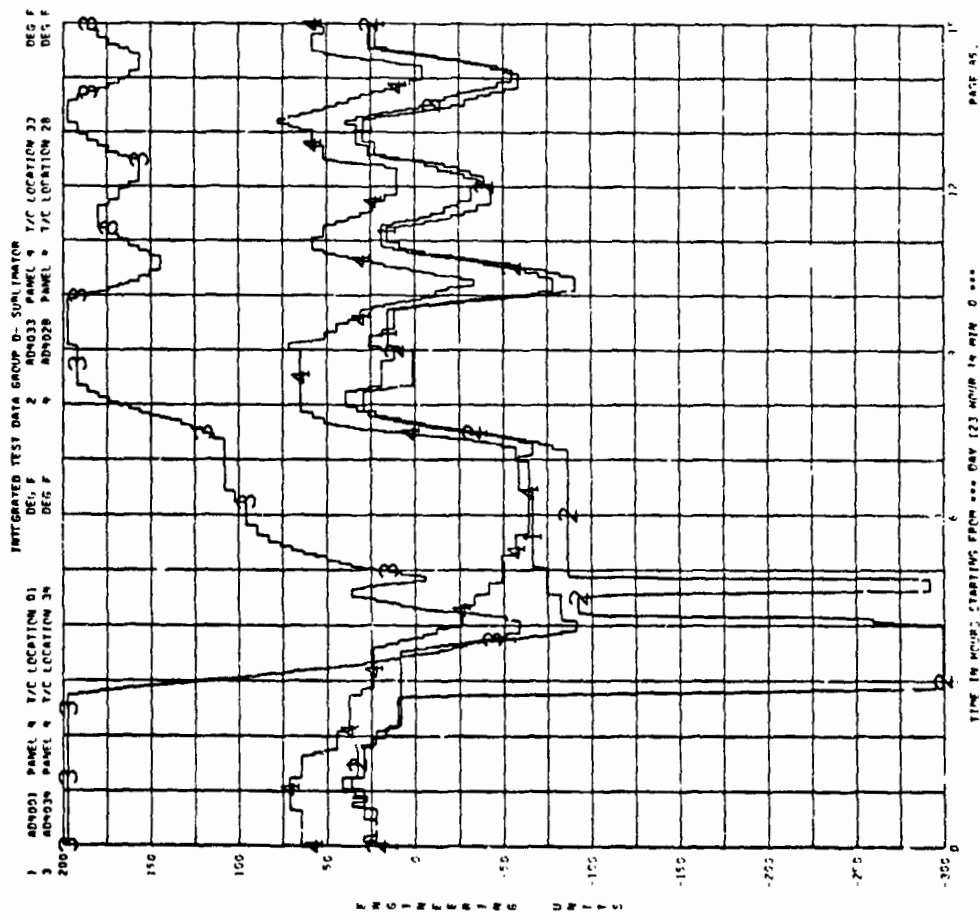
PAGE 82



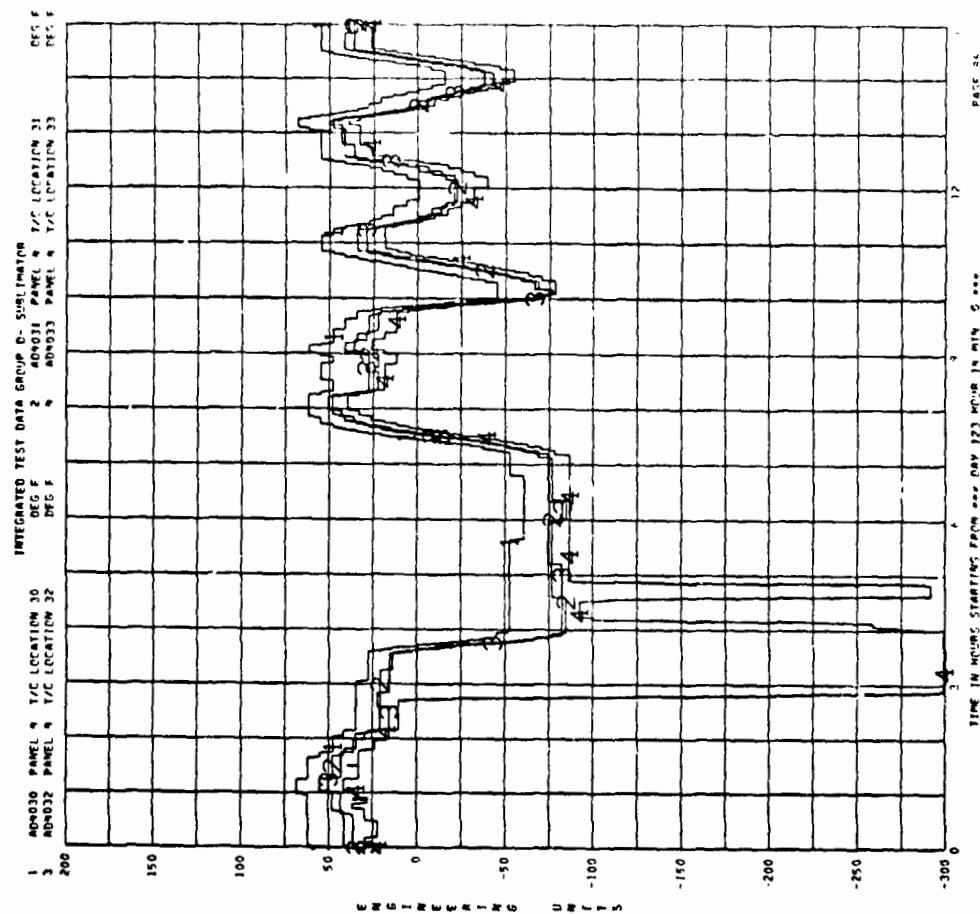
D-83



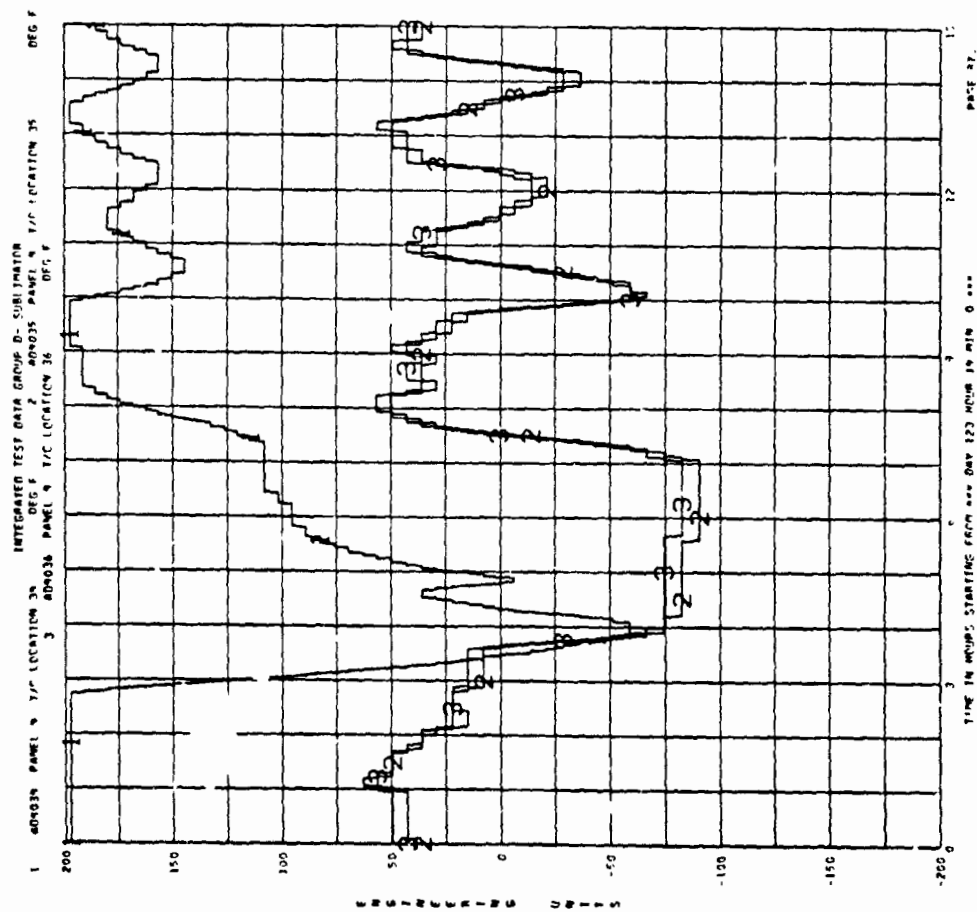
D-84



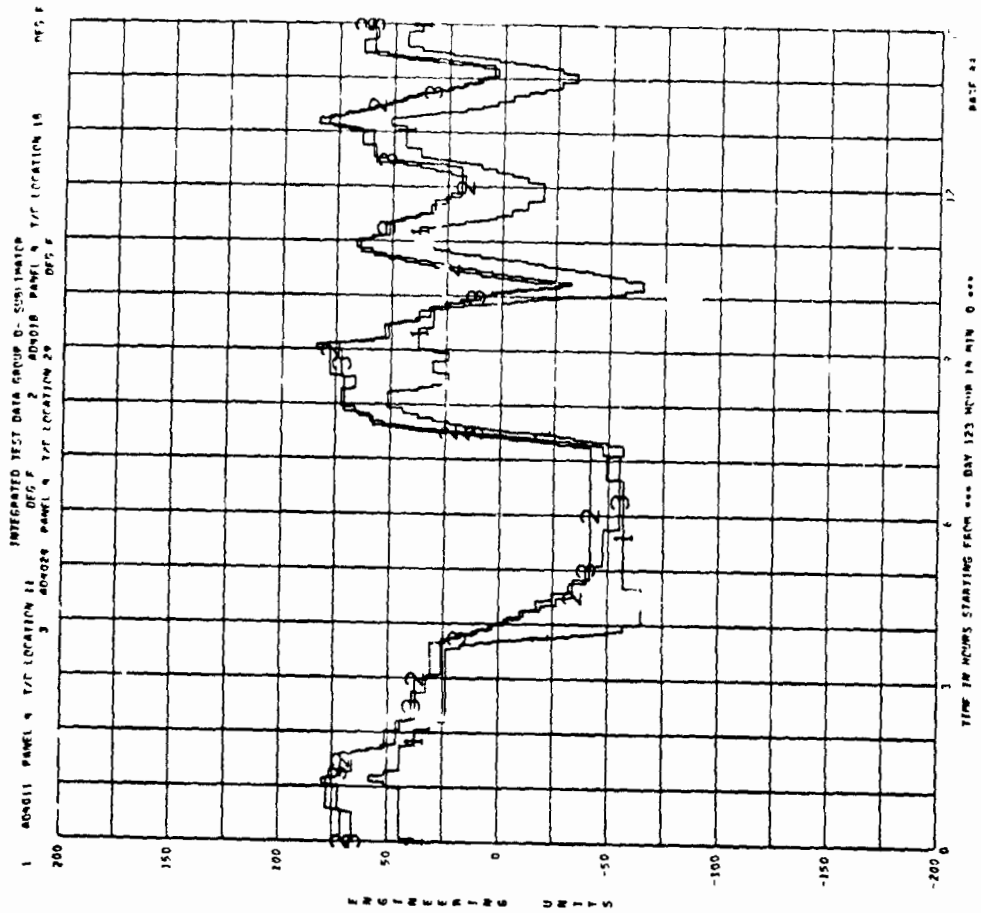
D-85



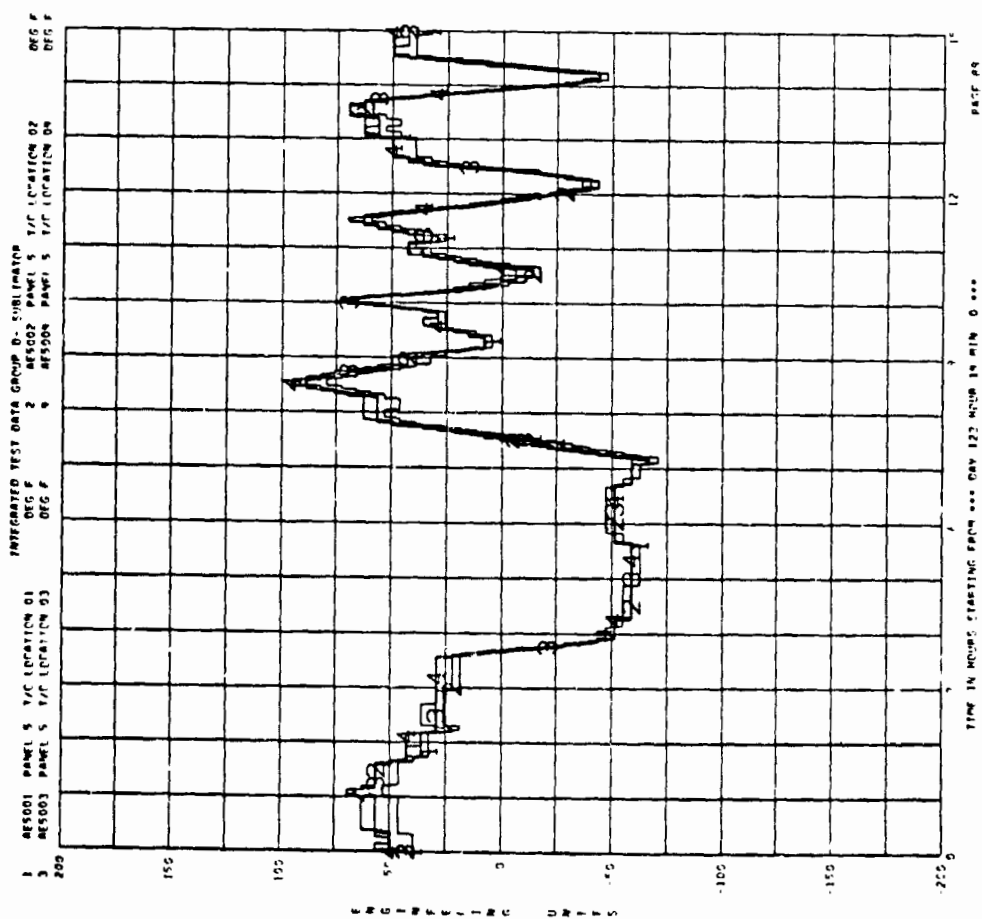
D-86



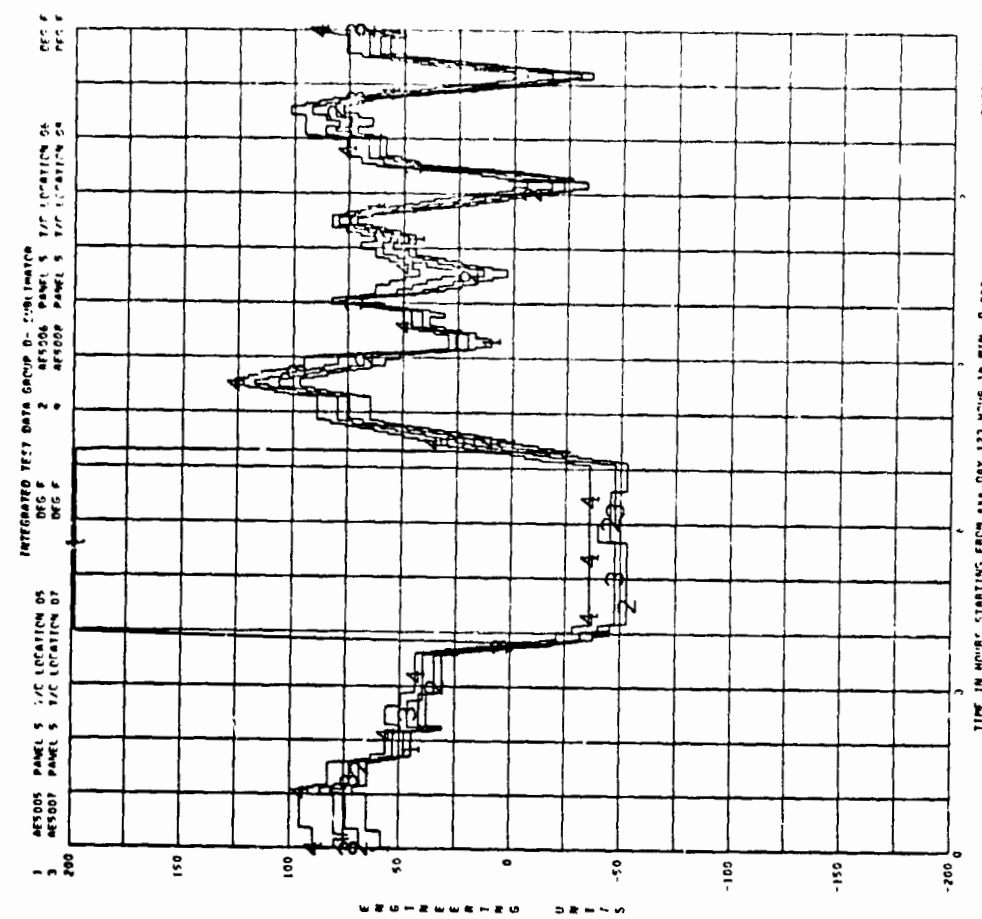
D-87



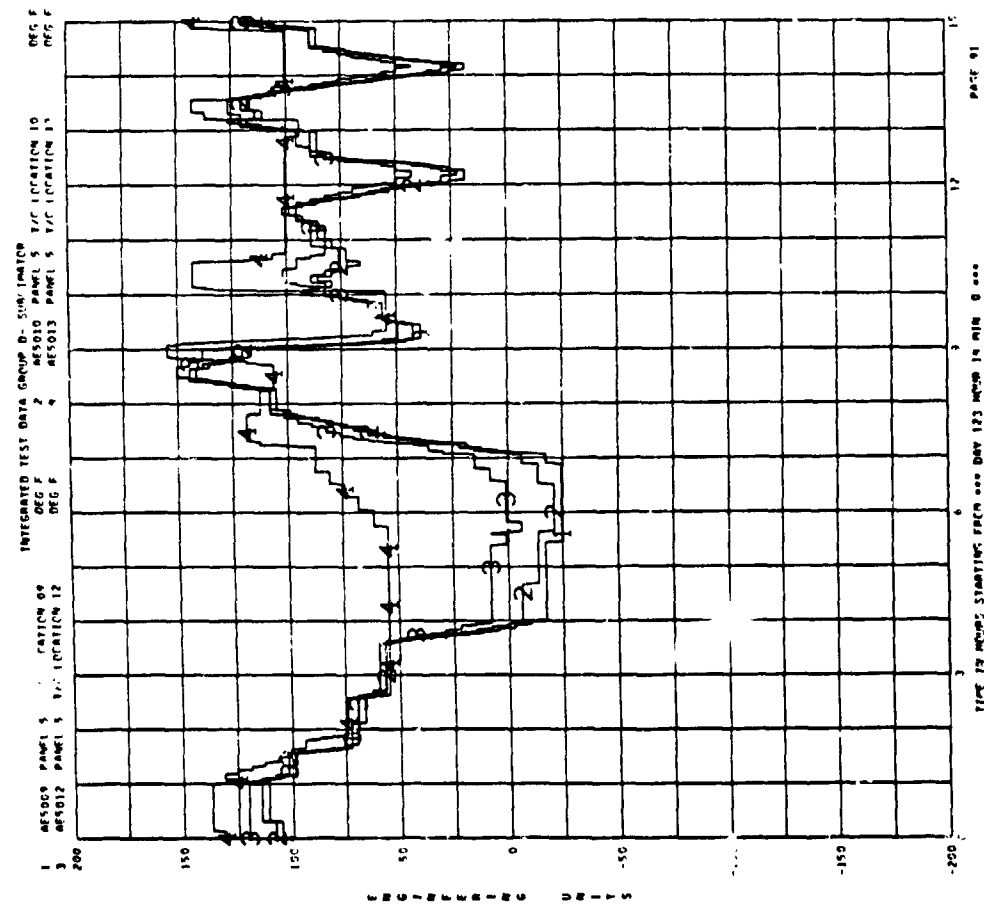
D-88



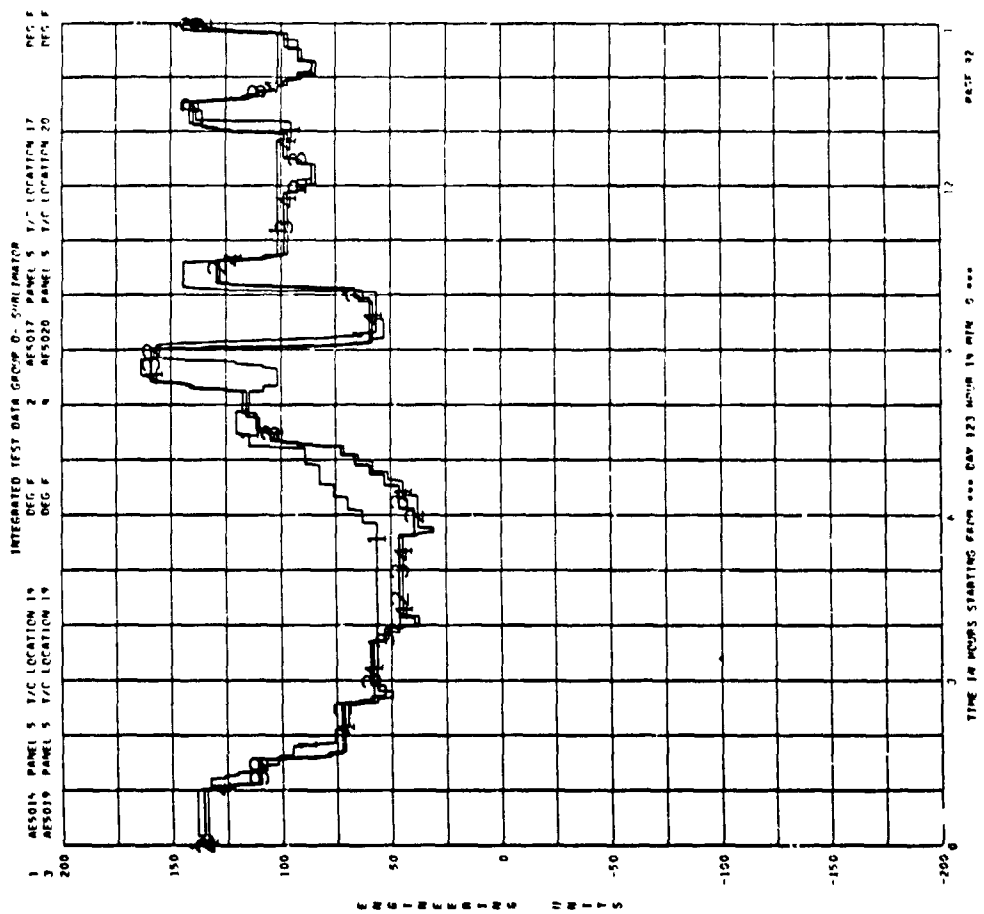
D-89



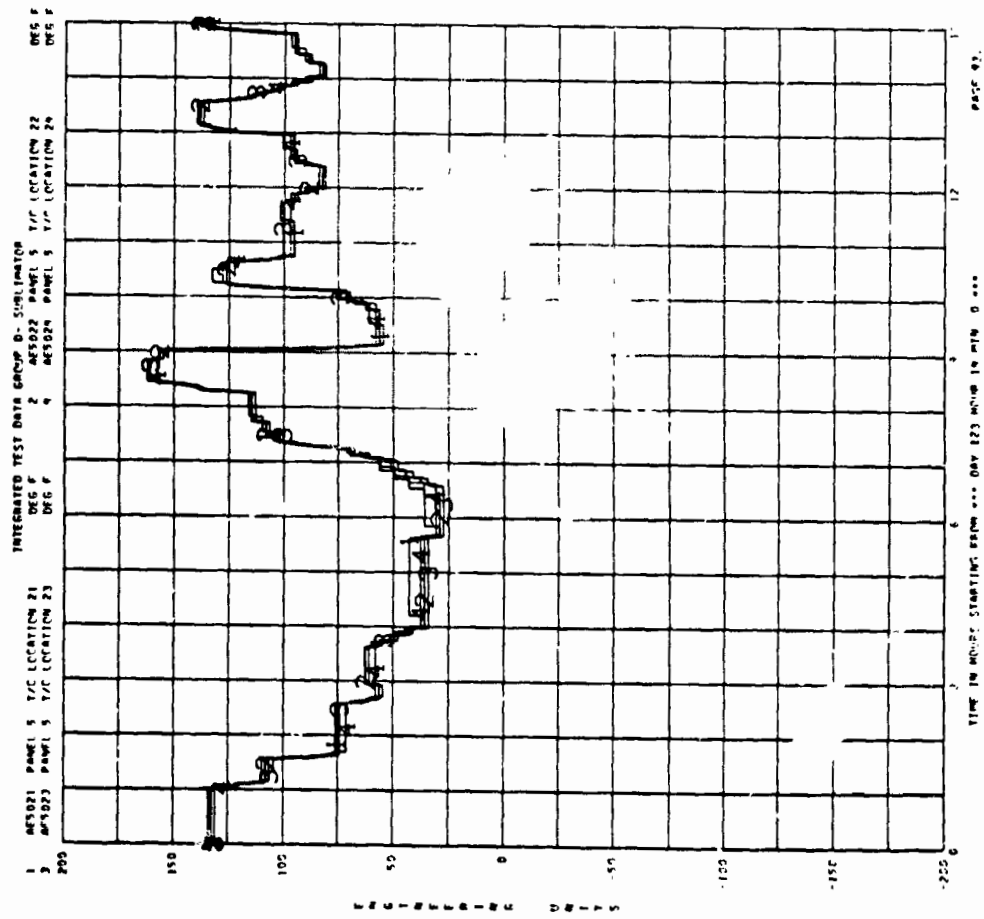
D-90



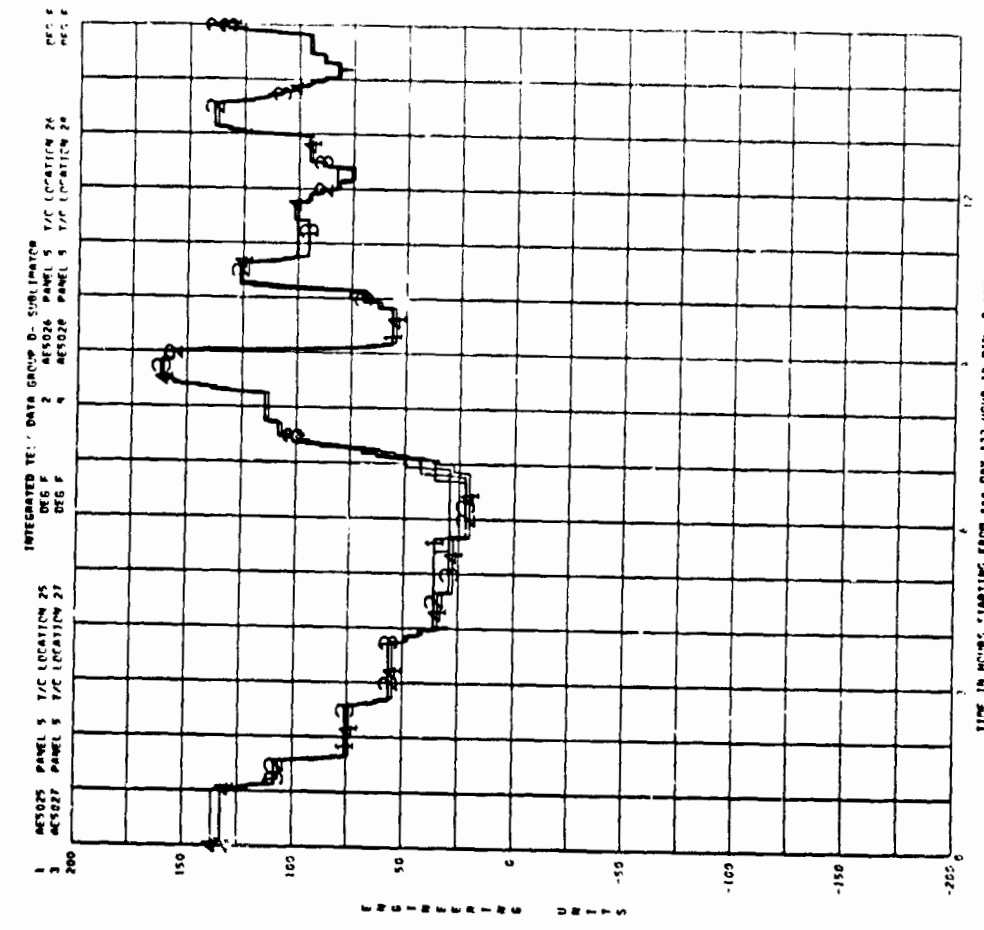
D-91



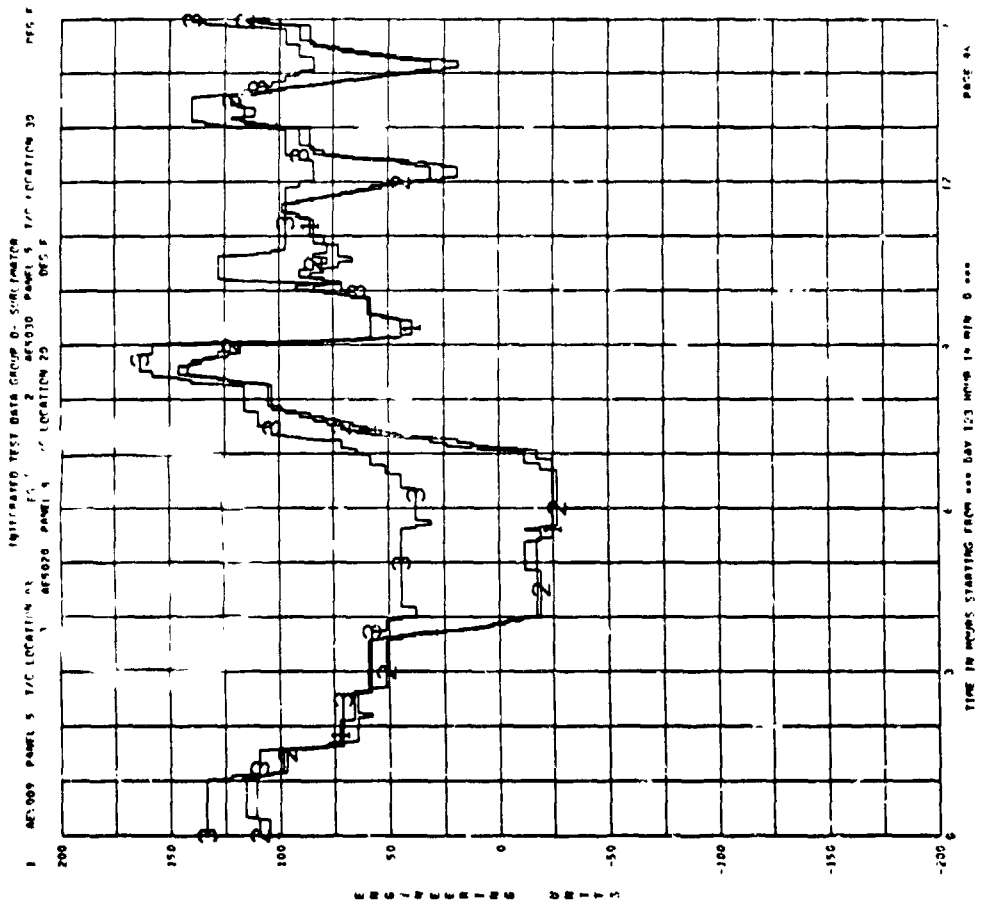
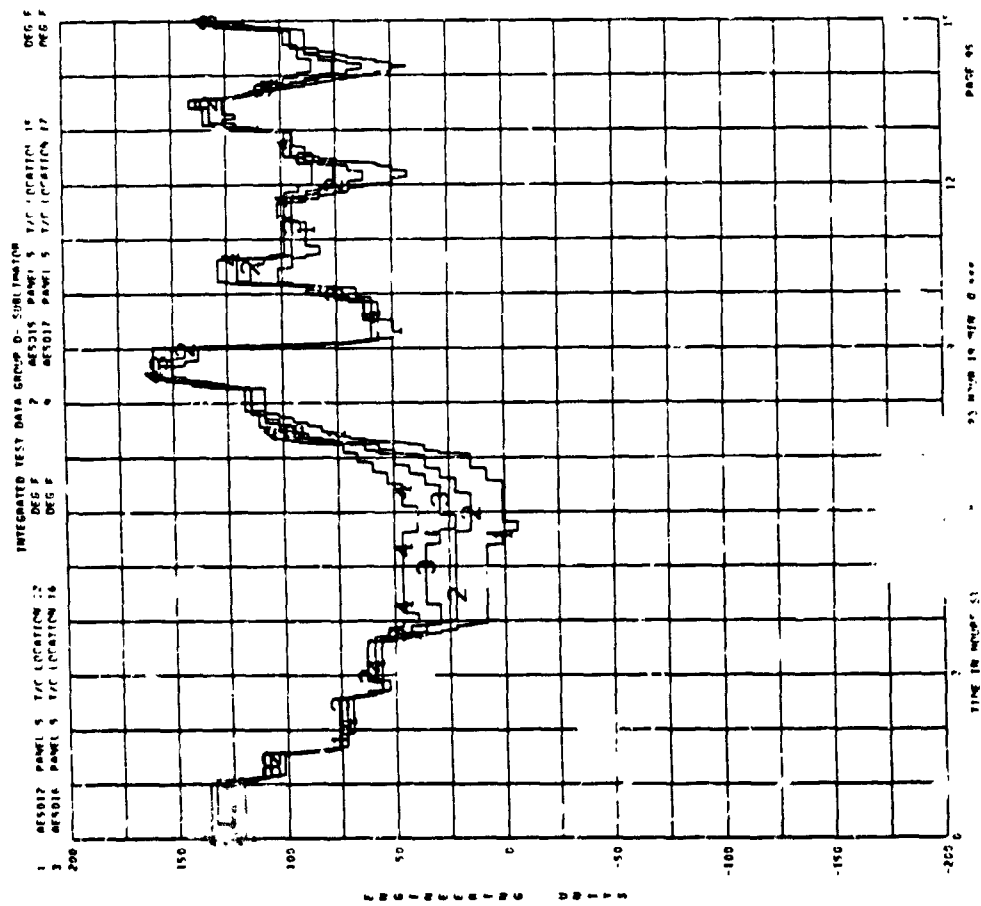
D-92

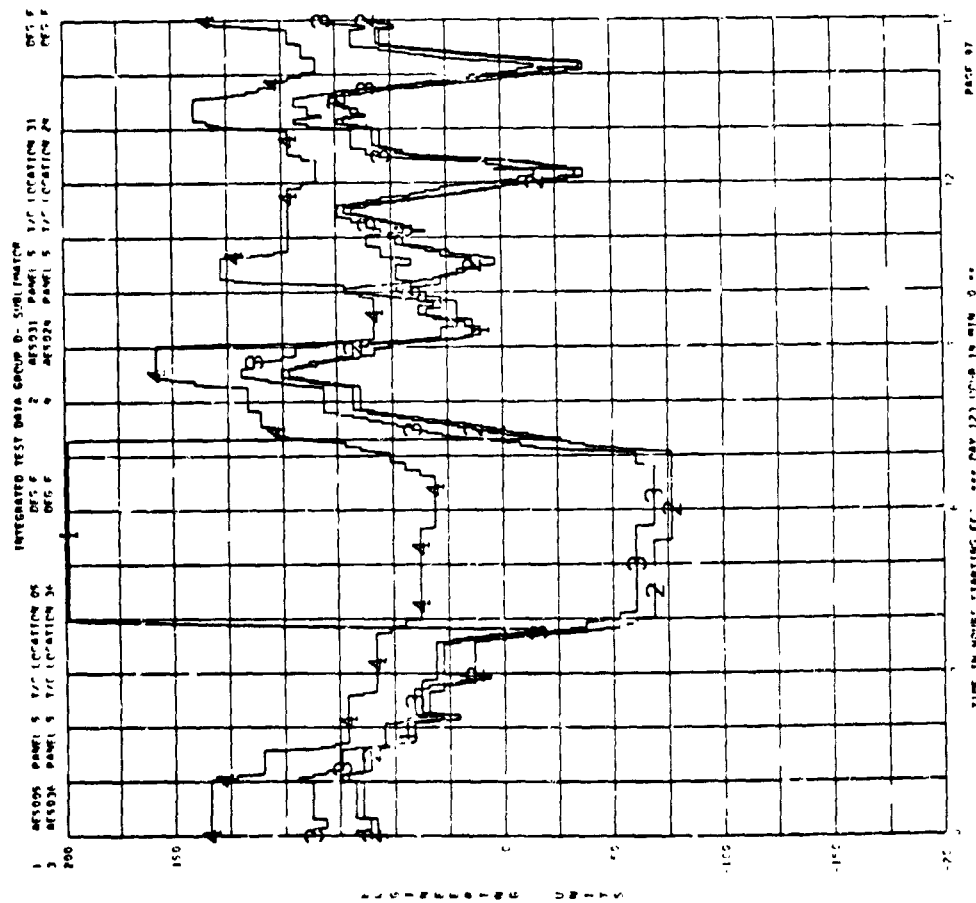


D-93

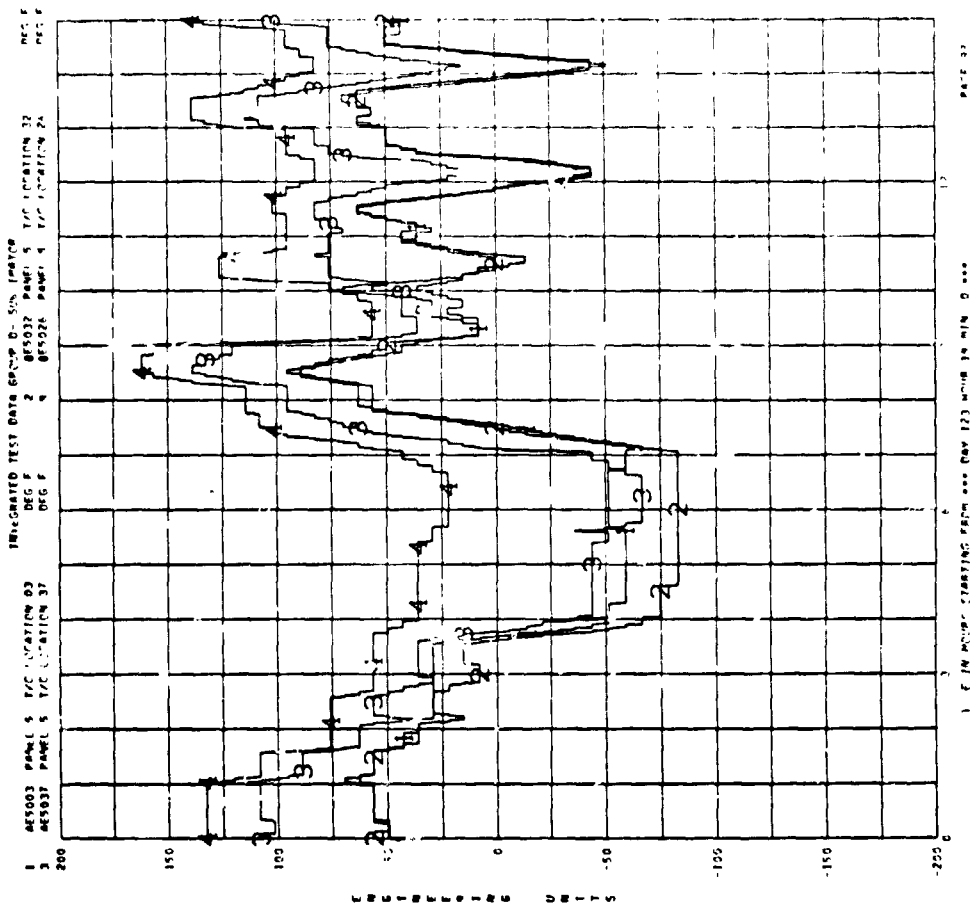


D-94

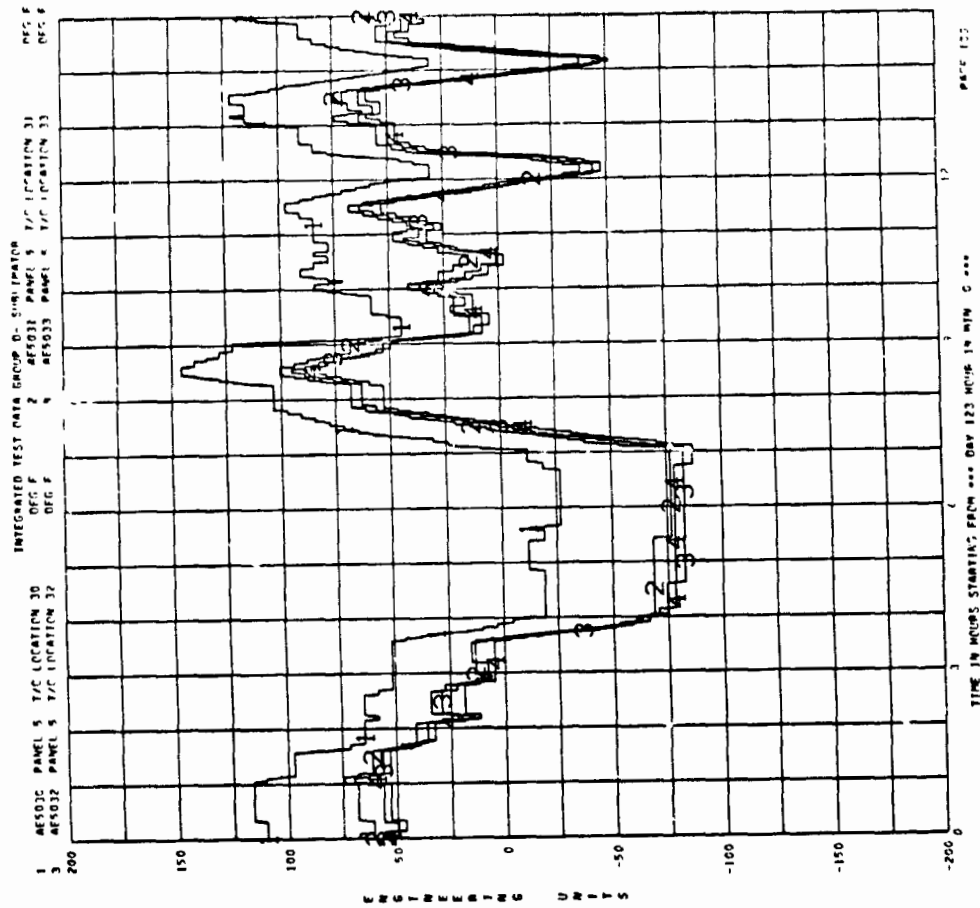




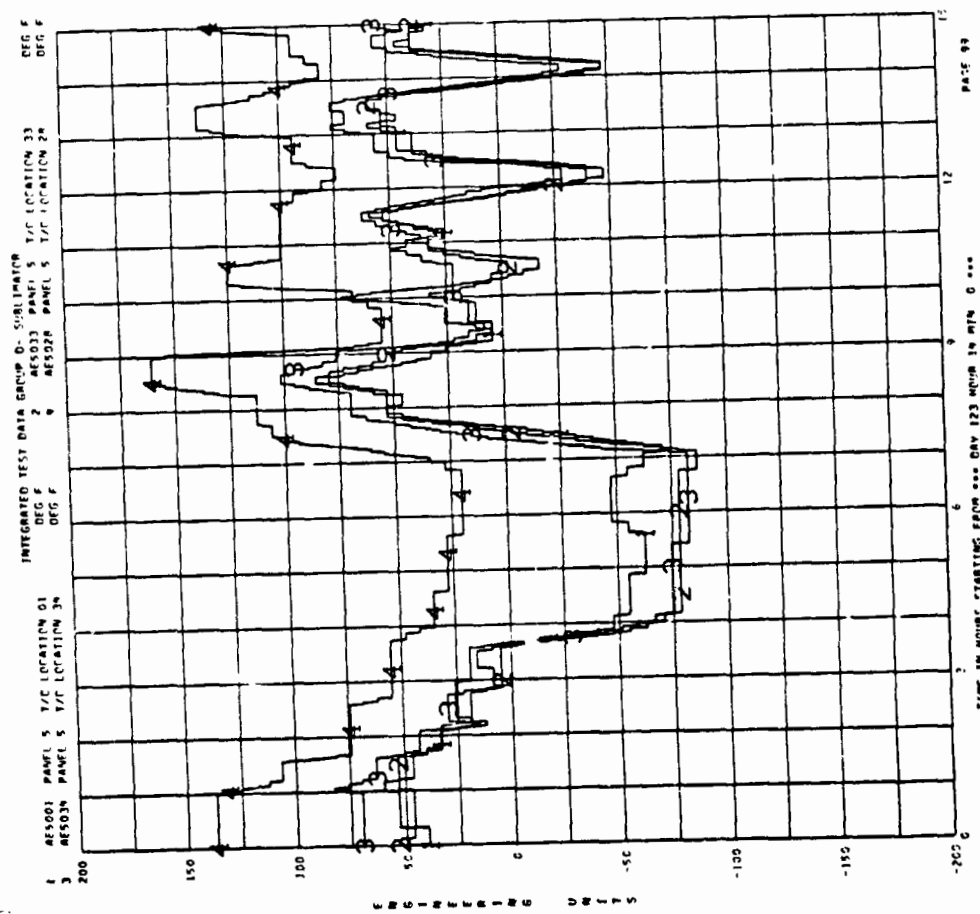
D-97



D-98



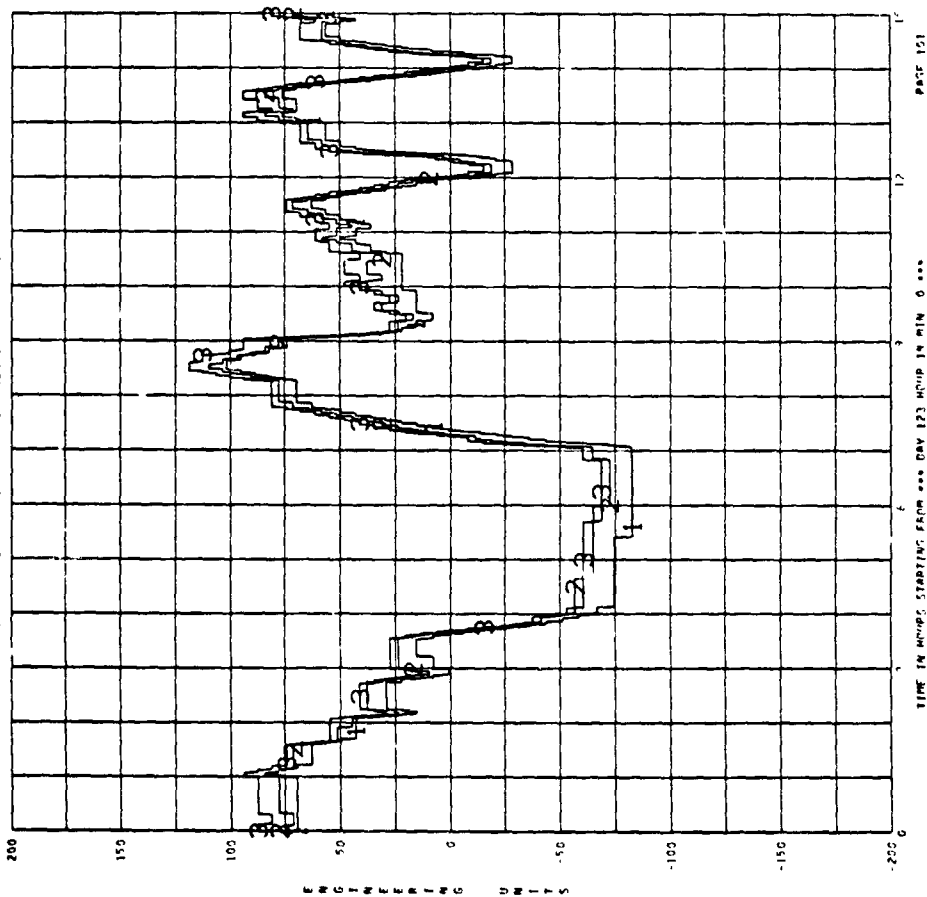
D-100



D-99

1 ARES034 PANEL 5 T/C LOCATION 34 DEG F 2 ARES035 PANEL 5 T/C LOCATION 35 DEG F 3 ARES036 PANEL 5 T/C LOCATION 36 DEG F

INTEGRATED TEST DATA GROUP D- SUBLIMATOR



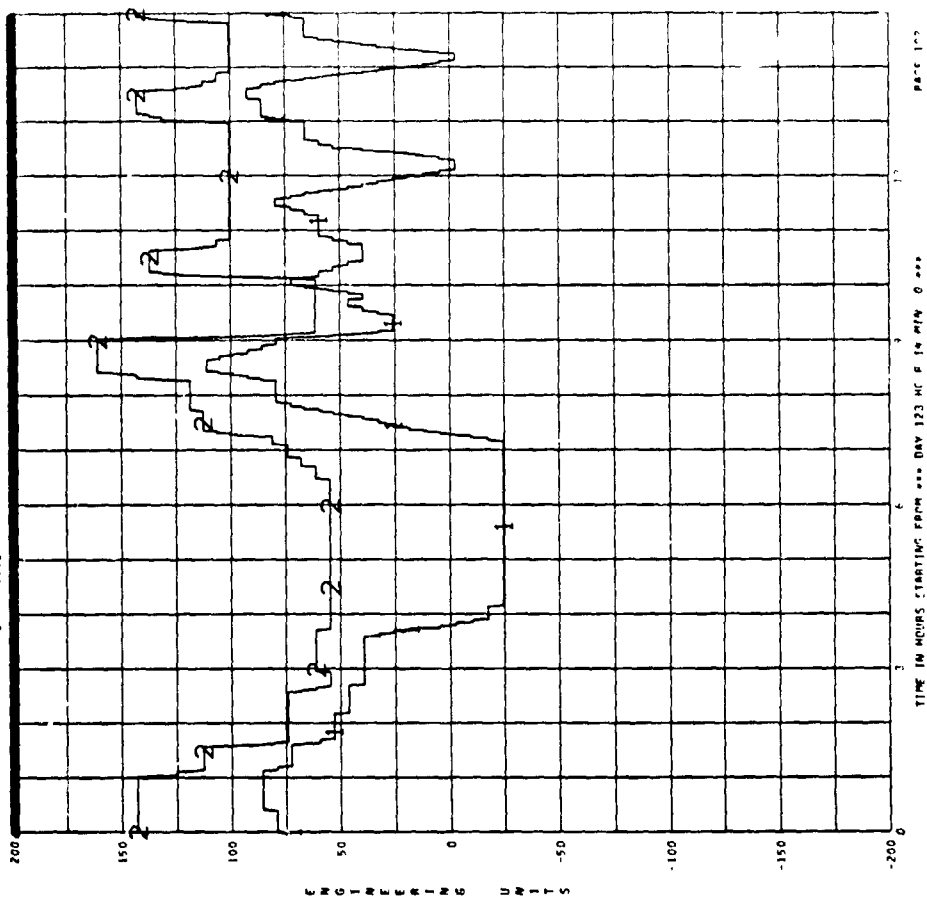
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TIME IN HOURS STARTING FROM 000 DAY 123 HOUR 14 MIN 0 000

D-101

1 ARES011 PANEL 5 T/C LOCATION 11 DEG F 2 ARES012 PANEL 5 T/C LOCATION 12 DEG F 3 ARES029 PANEL 5 T/C LOCATION 29 DEG F

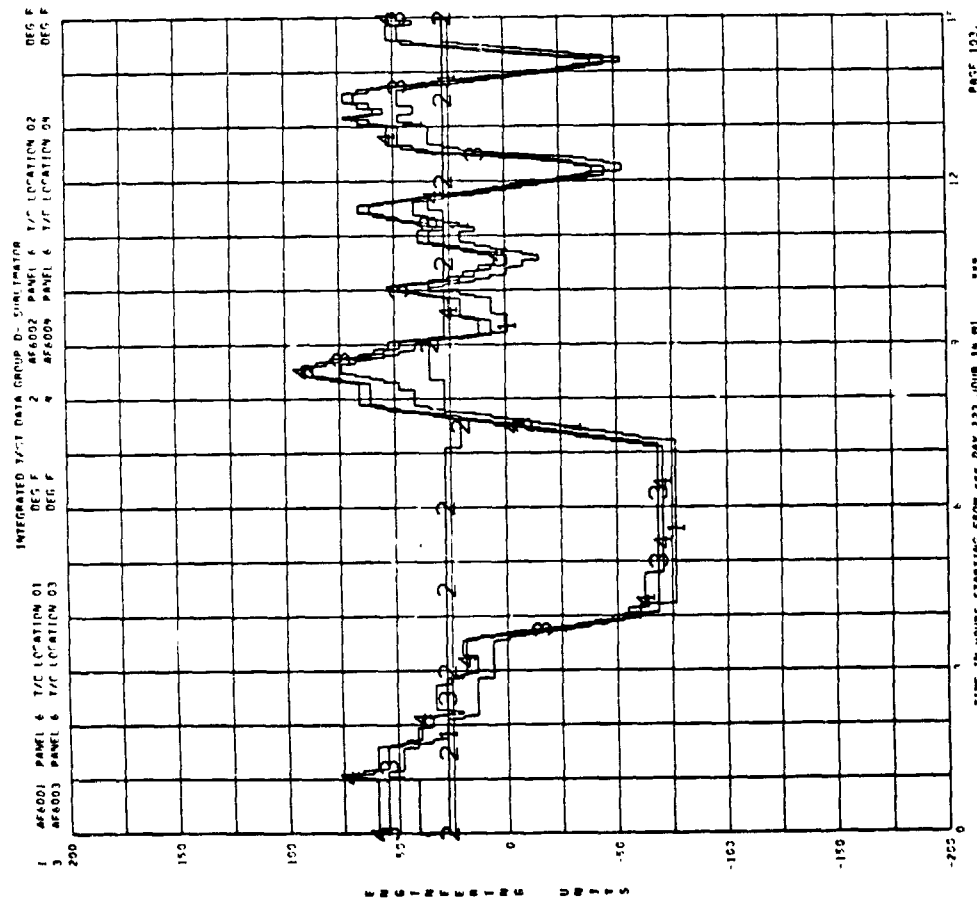
INTEGRATED TEST DATA GROUP D- SUBLIMATOR



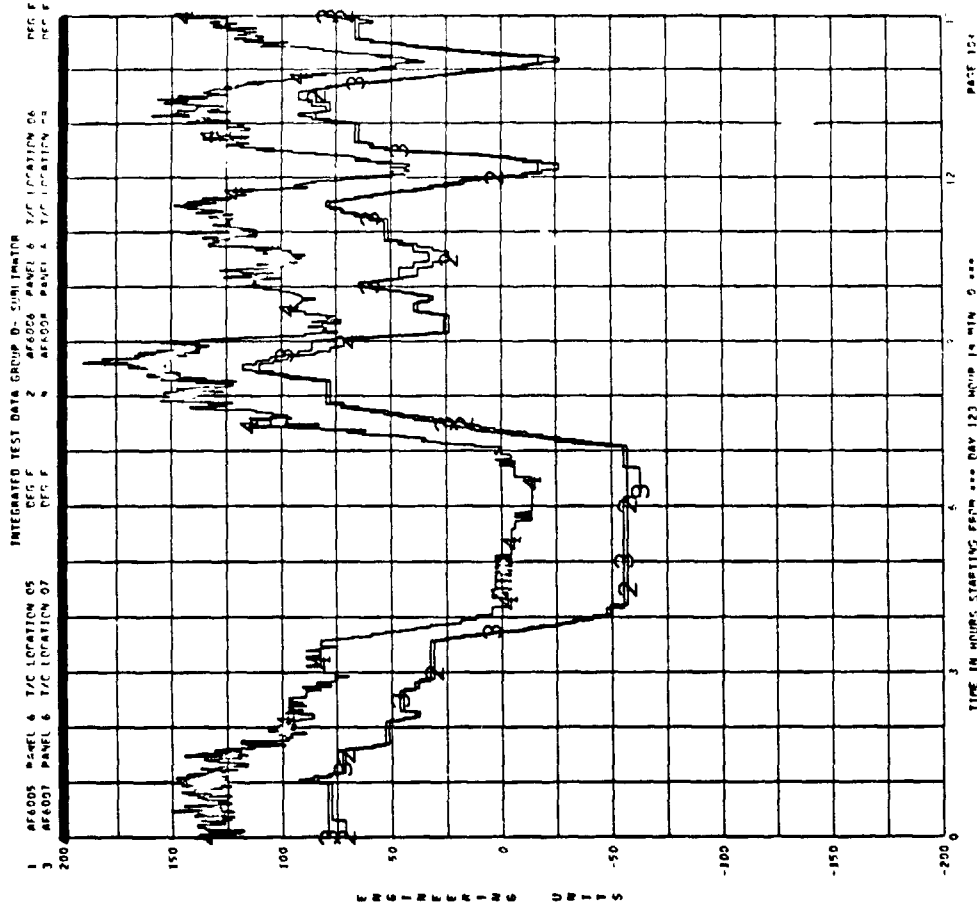
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TIME IN HOURS STARTING FROM 000 DAY 123 HOUR 14 MIN 0 000

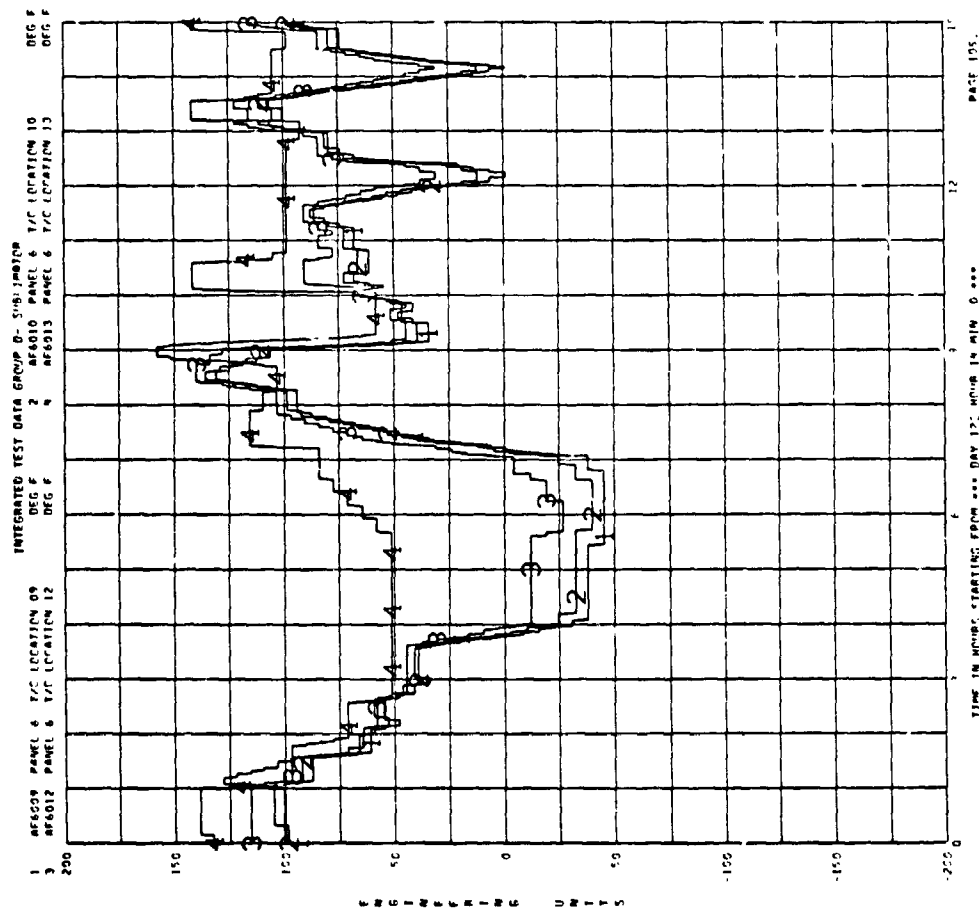
D-102



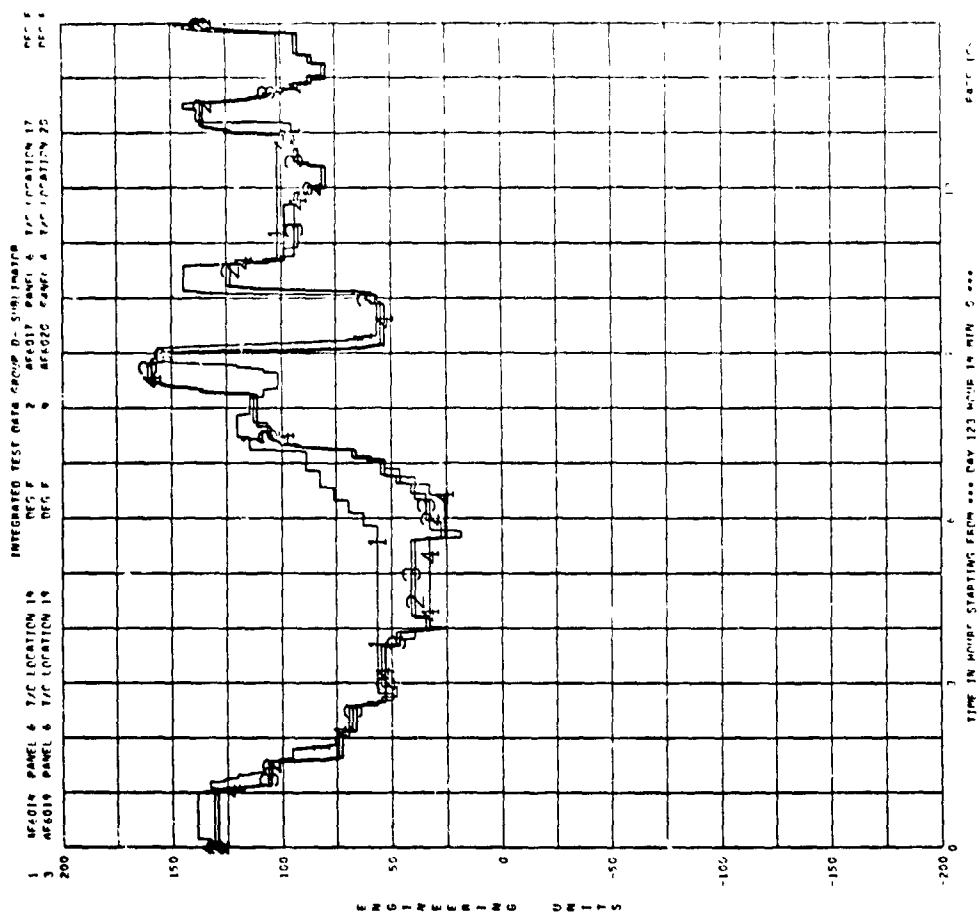
D-103



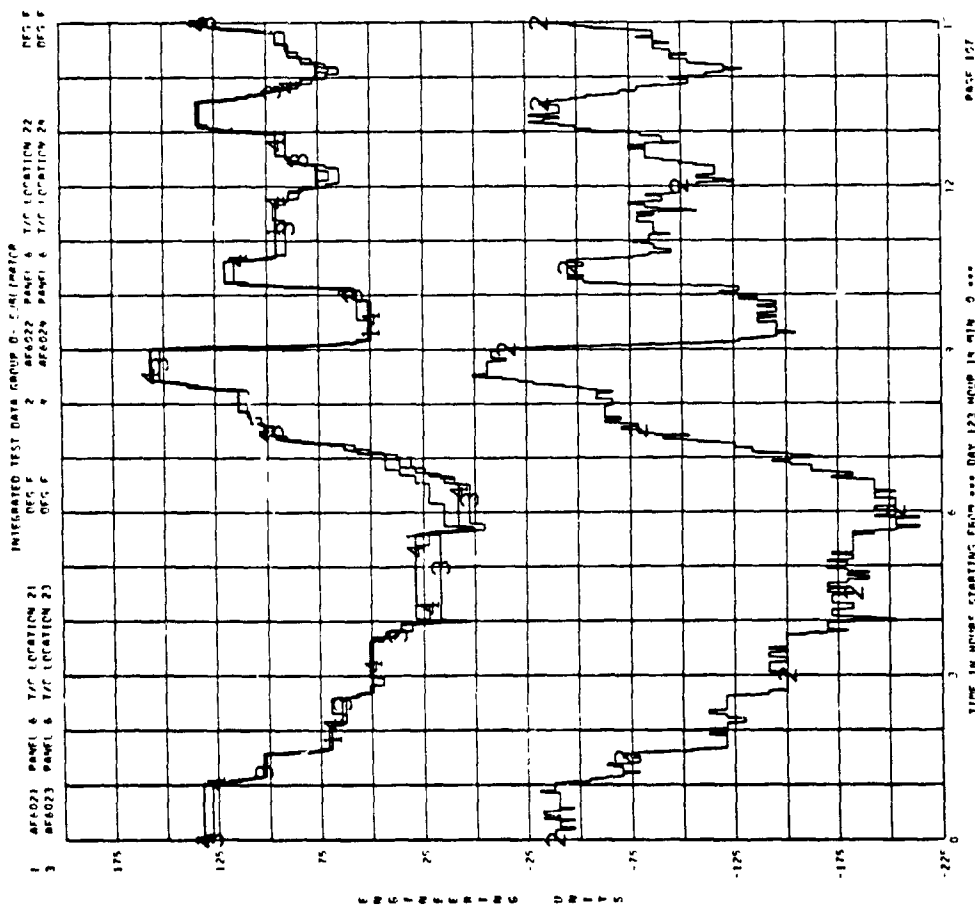
D-104



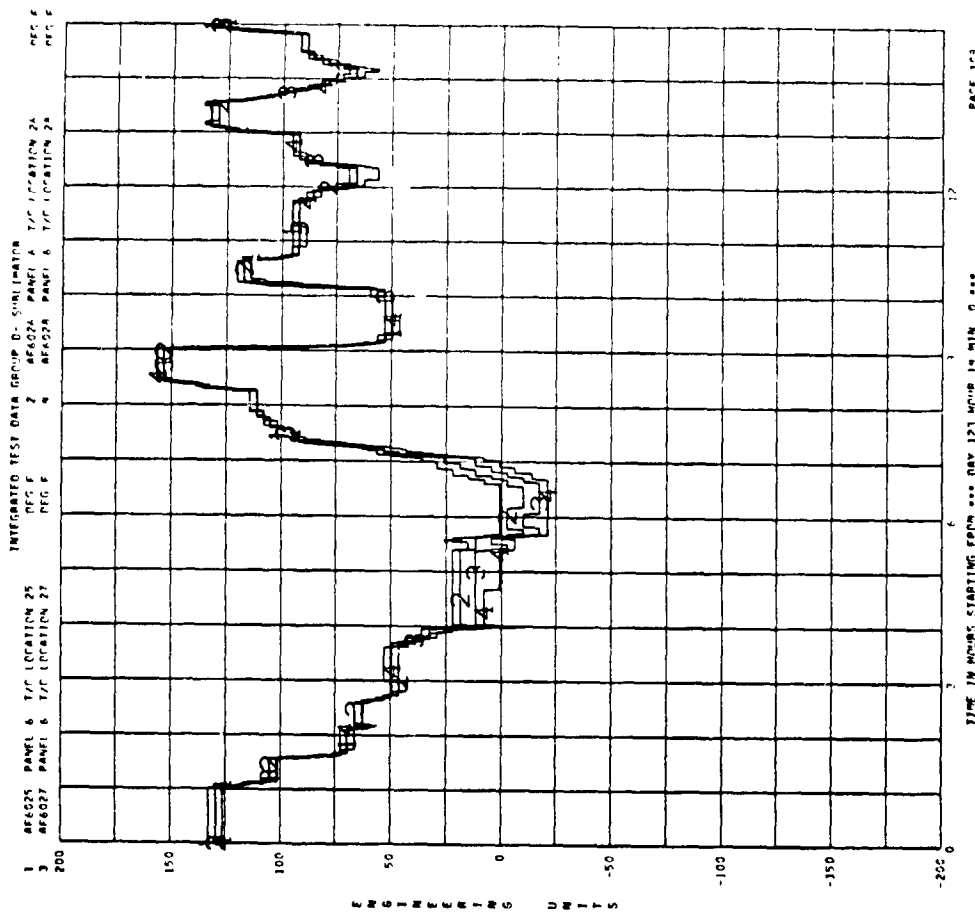
D-105

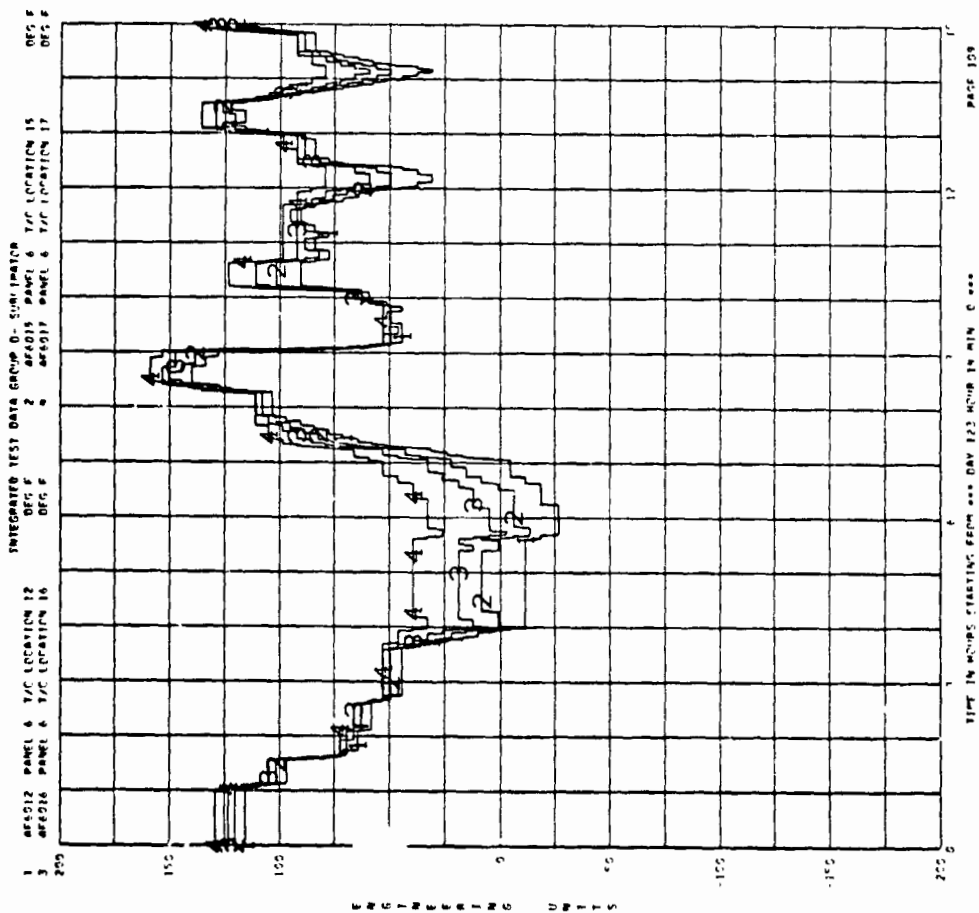


D-106

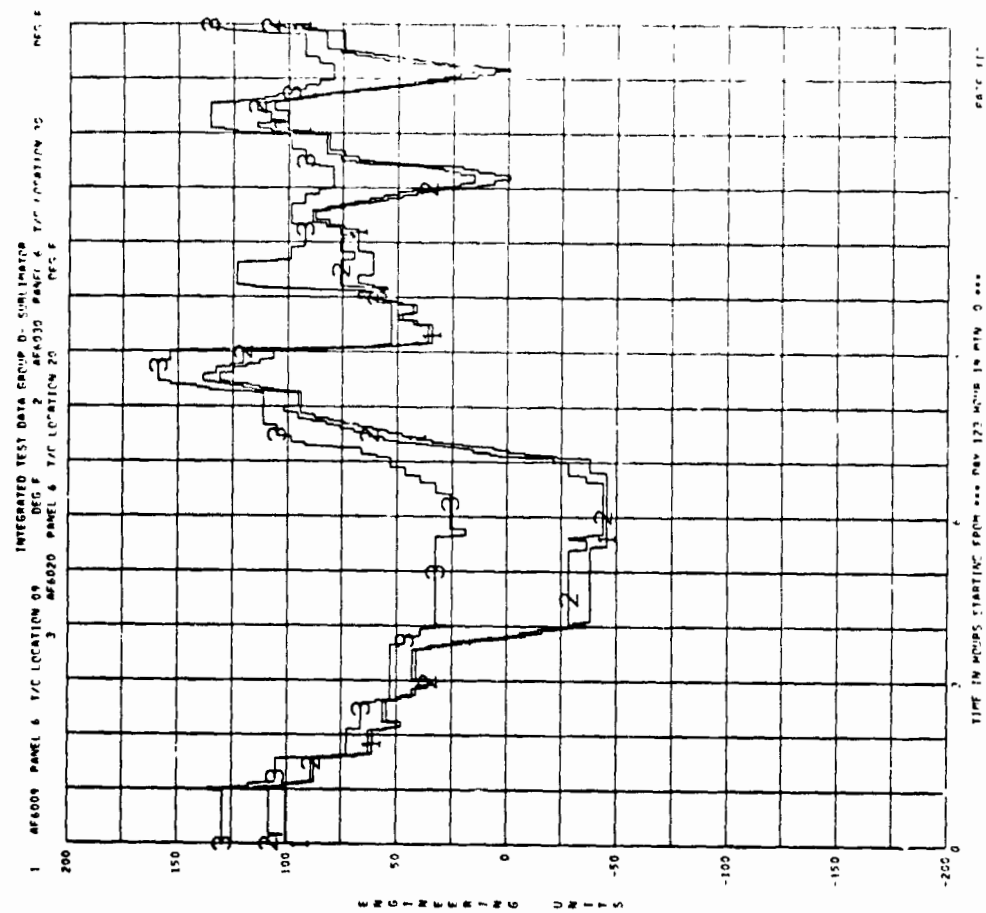


D-107

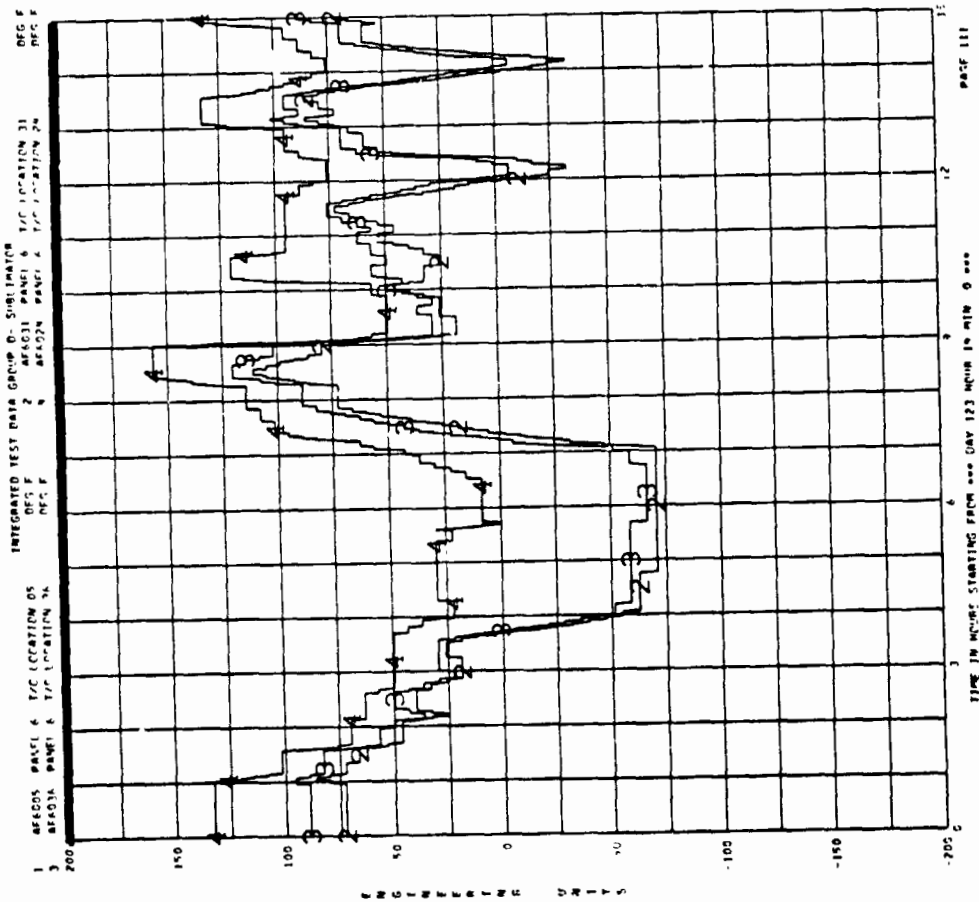




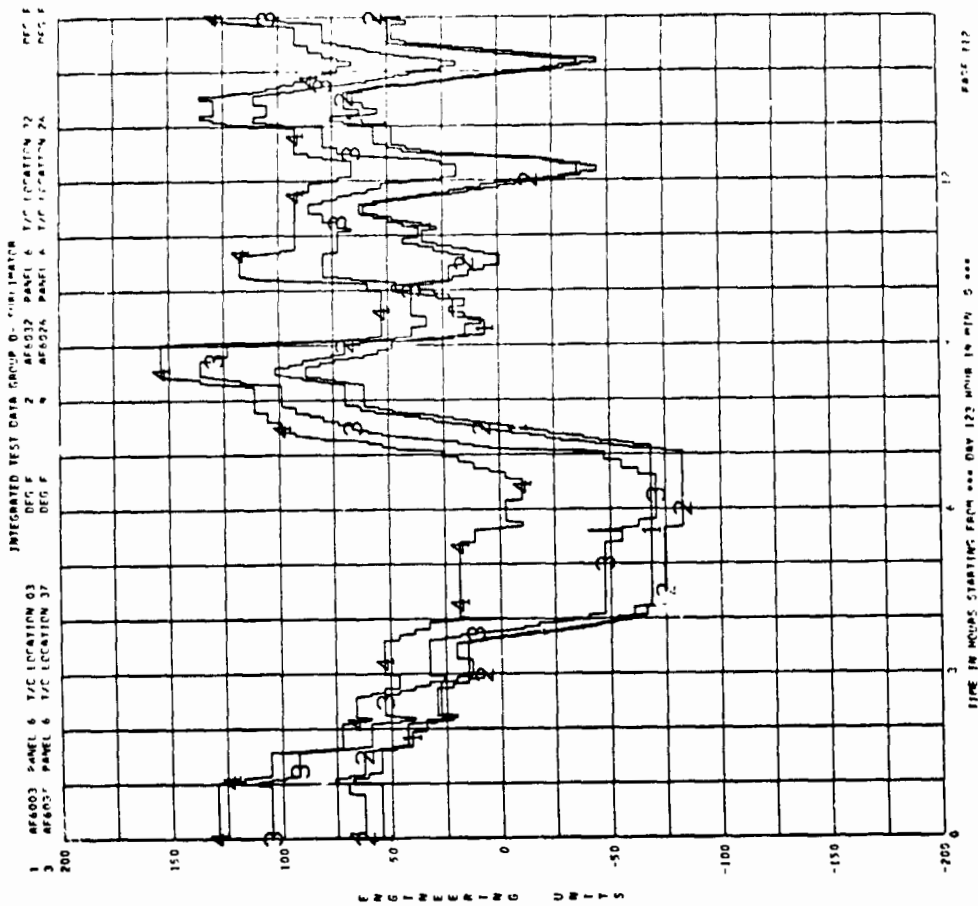
D-109



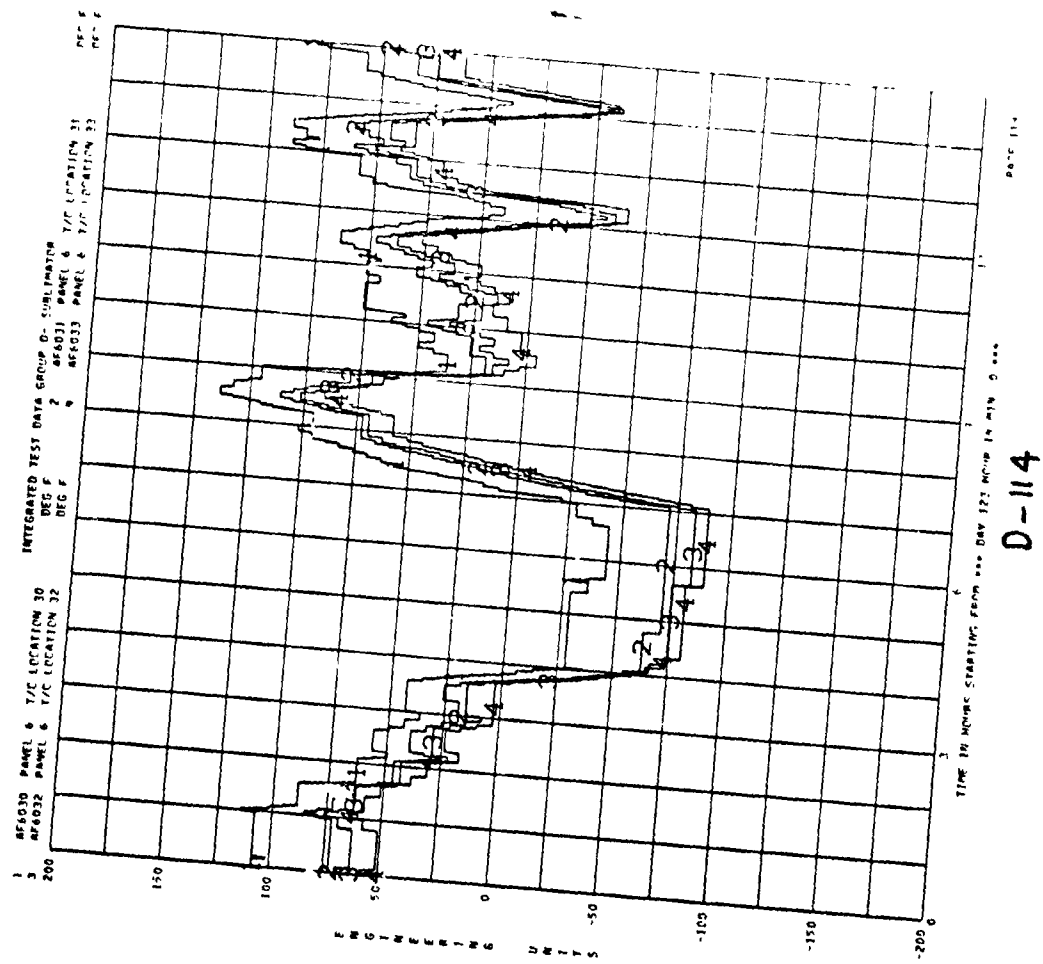
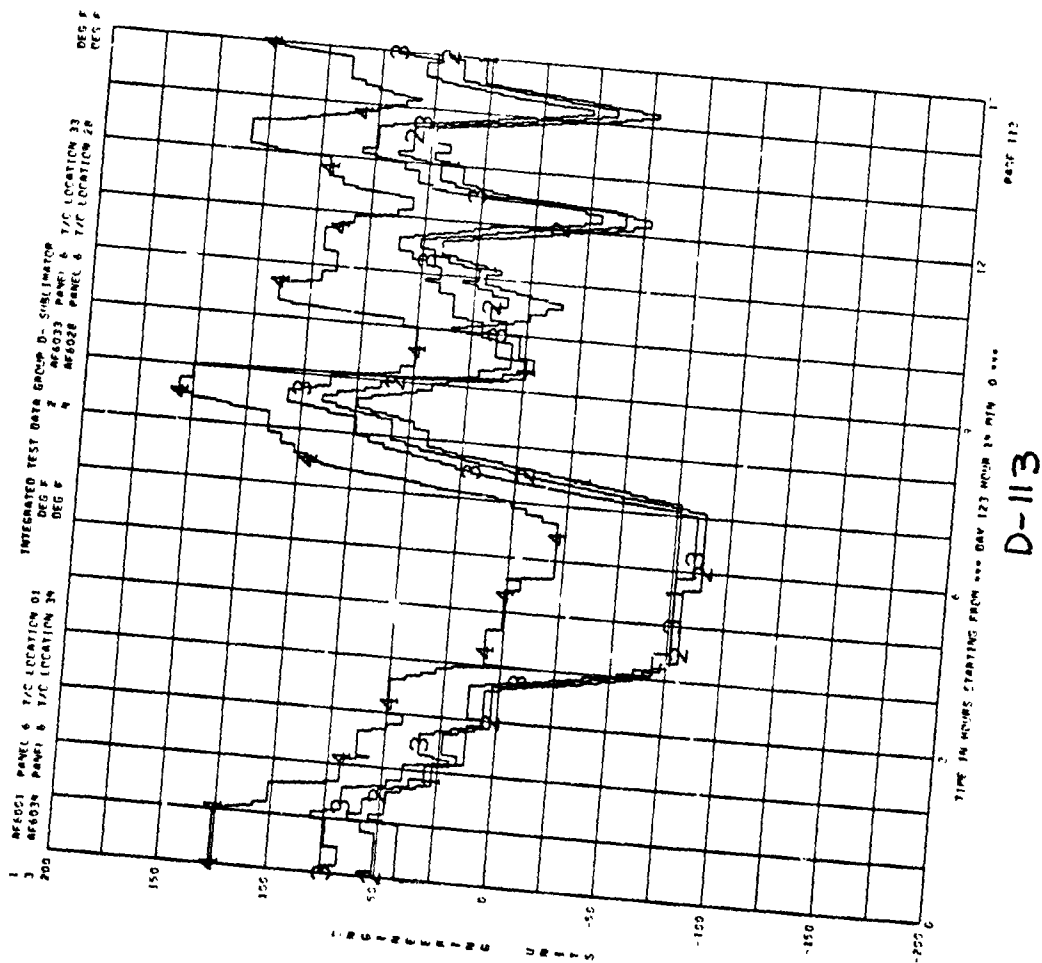
D-110

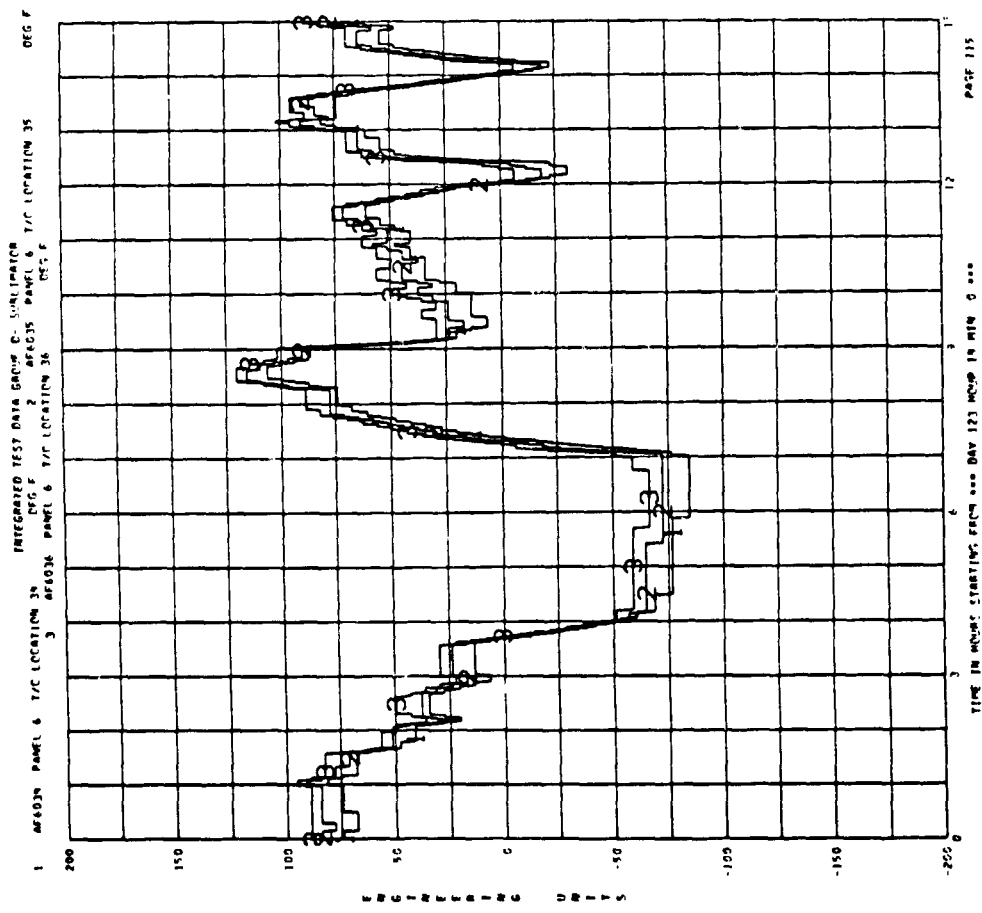


D-III

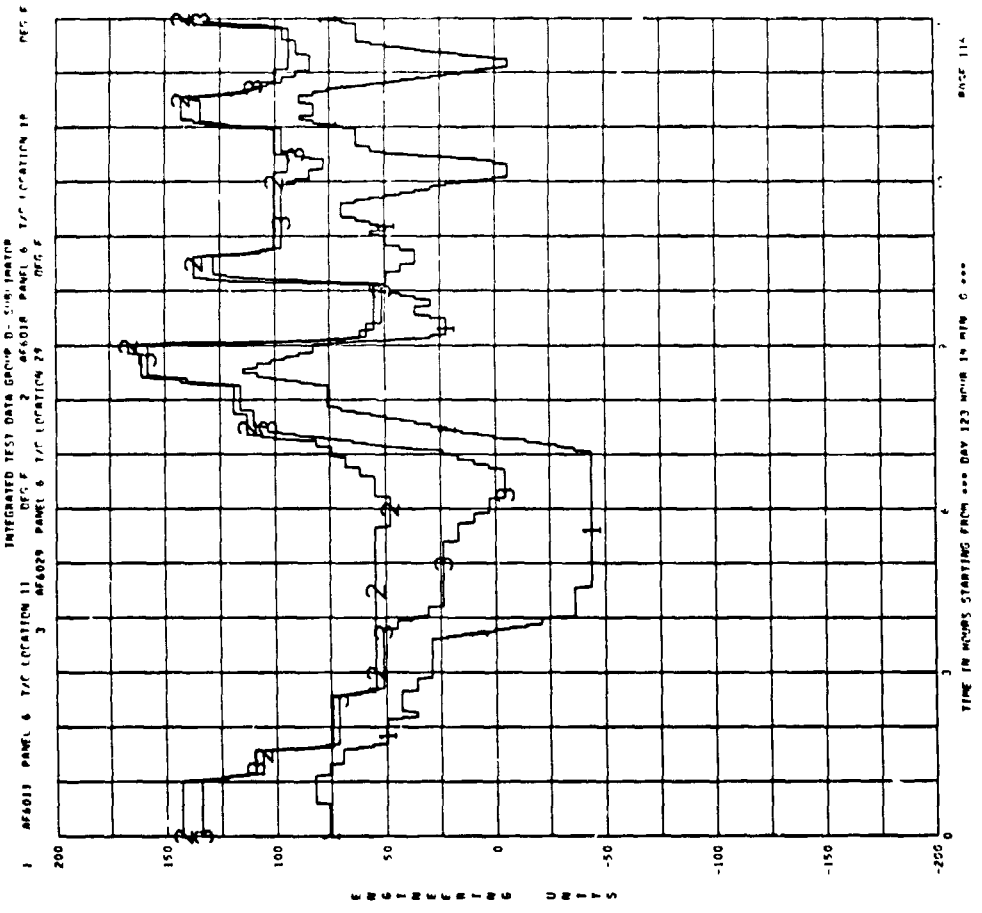


D-112





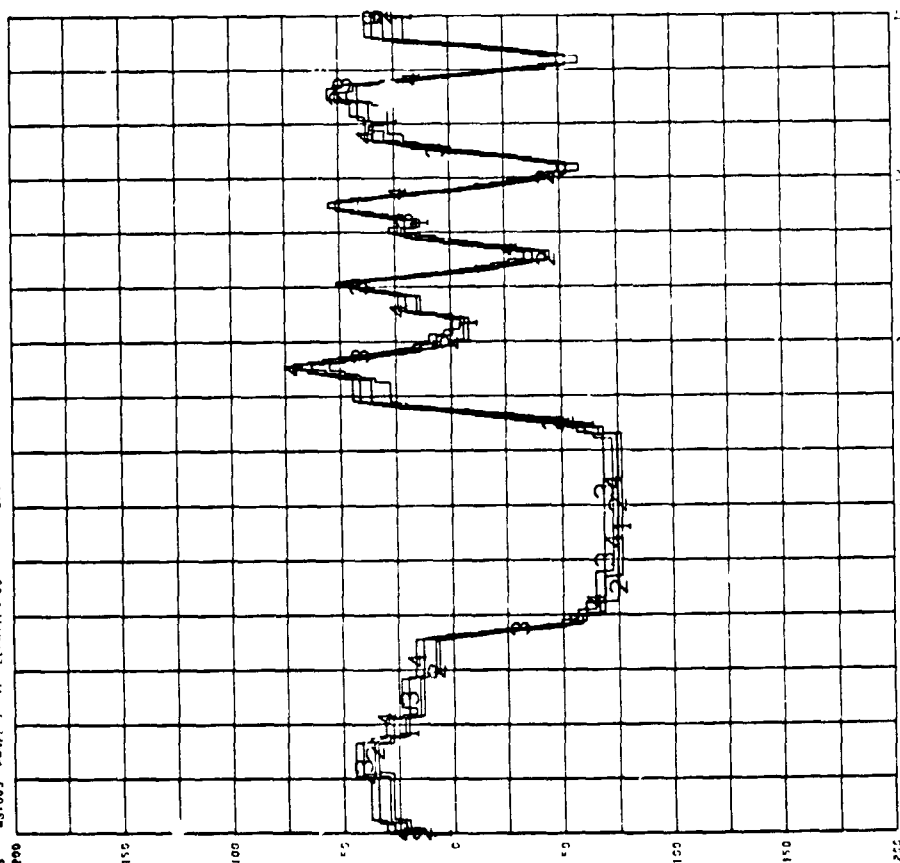
D-115



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INTEGRATED TEST DATA GROUP D- SUBIMATOR

1 ACT001 PANEL 7 T/C LOCATION 01 DEG F
2 ACT002 PANEL 7 T/C LOCATION 02 DEG F
3 ACT003 PANEL 7 T/C LOCATION 03 DEG F



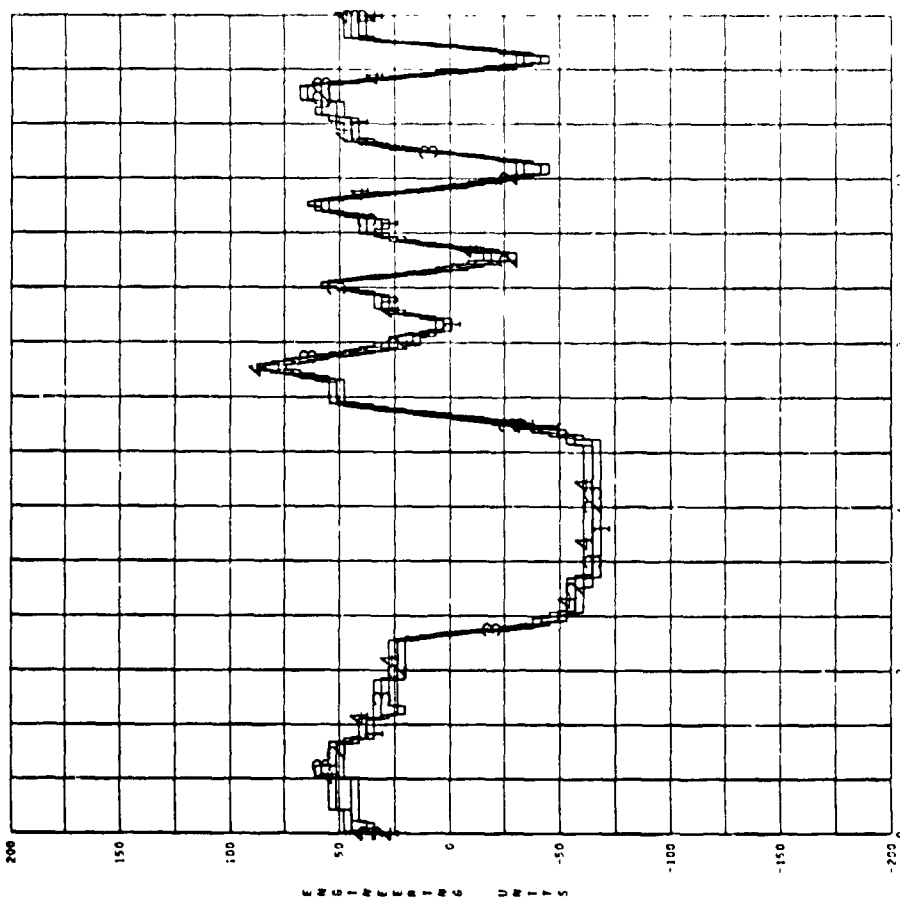
TIME IN HOURS STARTING FROM *** DAY 123 HOUR 10 MIN 0 ***

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INTEGRATED TEST DATA GROUP D- SUBIMATOR

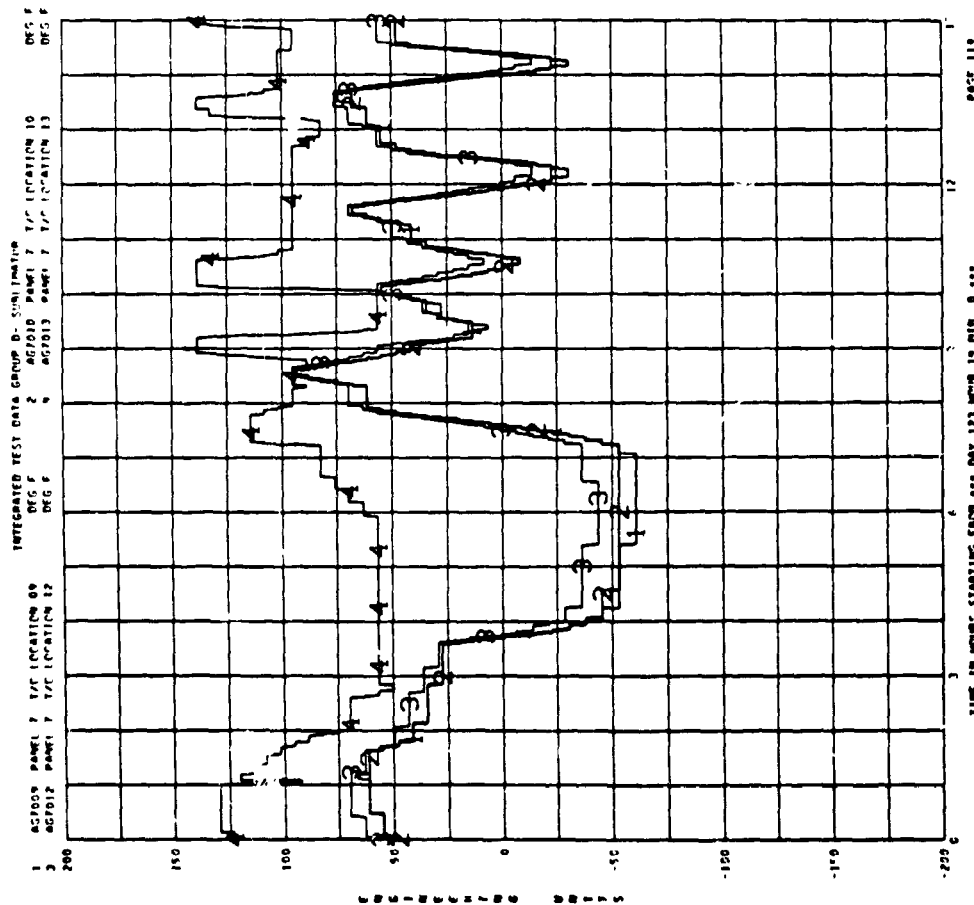
1 ACT005 PANEL 7 T/C LOCATION 05 DEG F
2 ACT006 PANEL 7 T/C LOCATION 06 DEG F
3 ACT007 PANEL 7 T/C LOCATION 07 DEG F



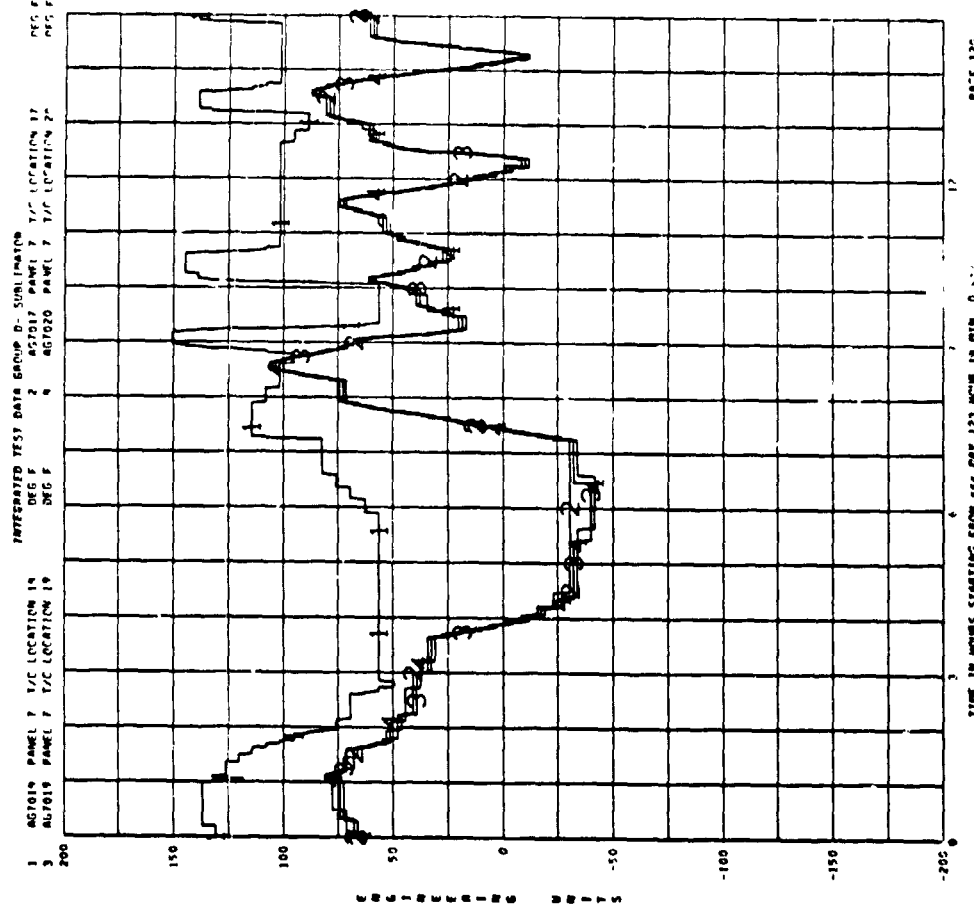
TIME IN HOURS STARTING FROM *** DAY 123 HOUR 10 MIN 0 ***

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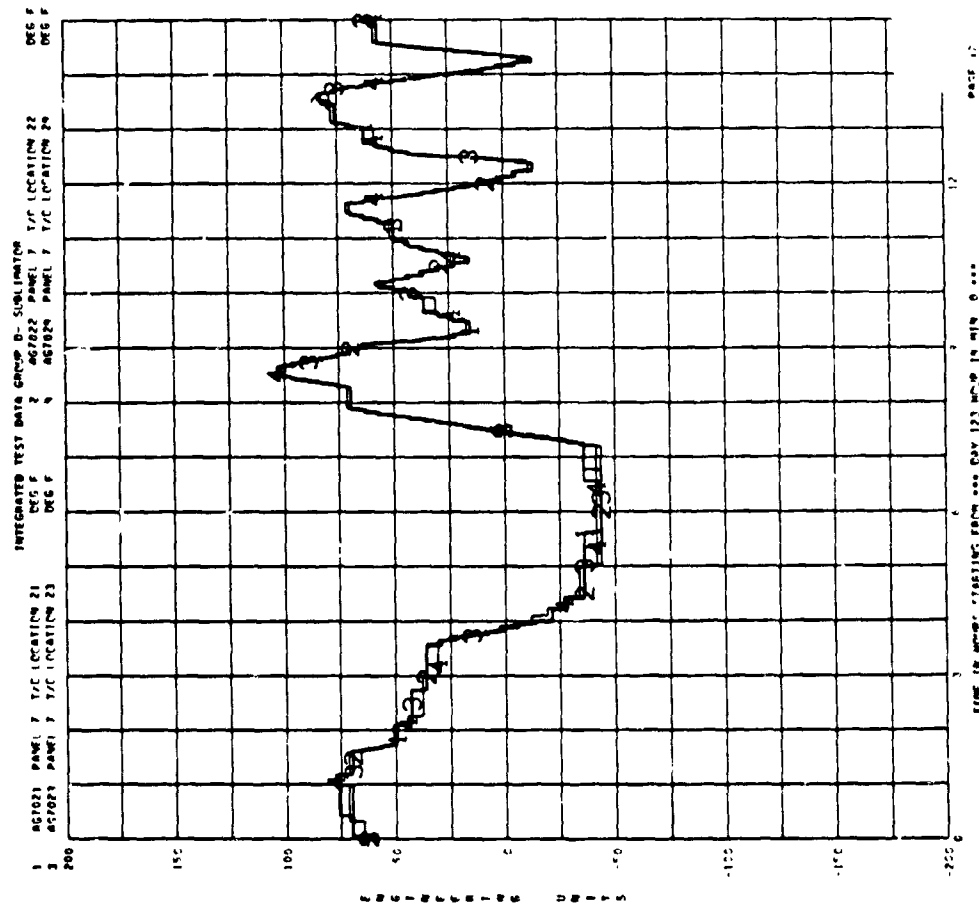
D-118



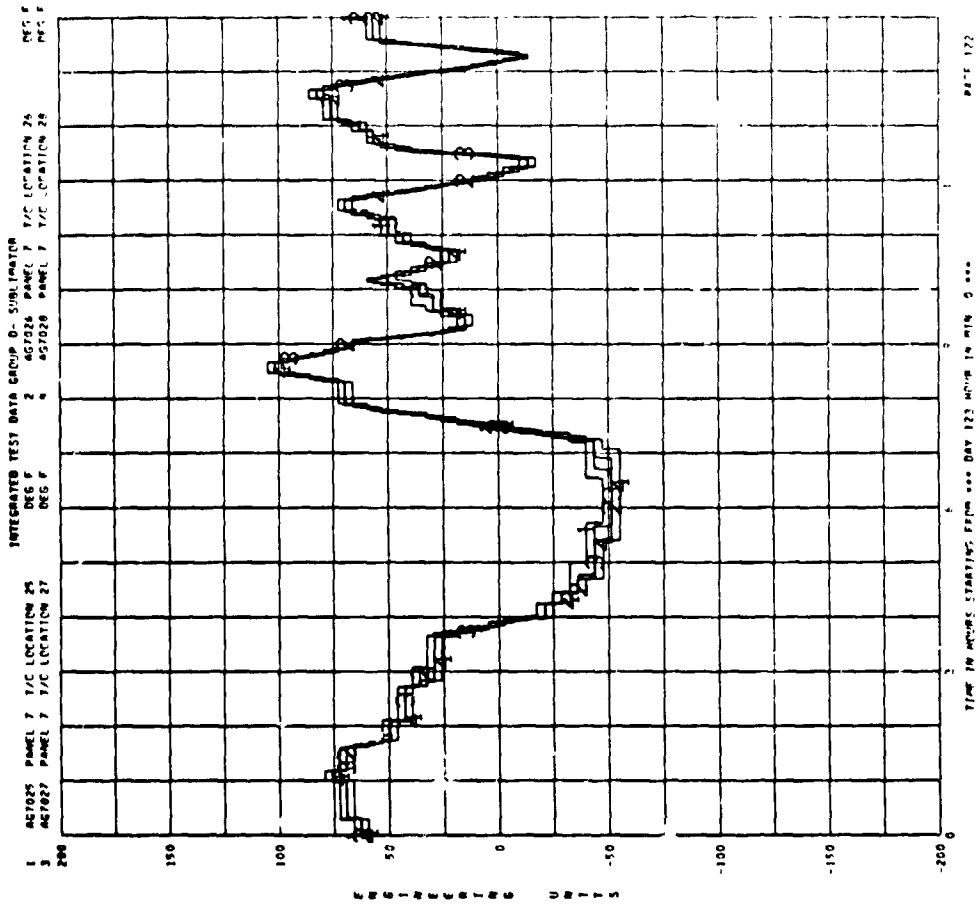
D-119



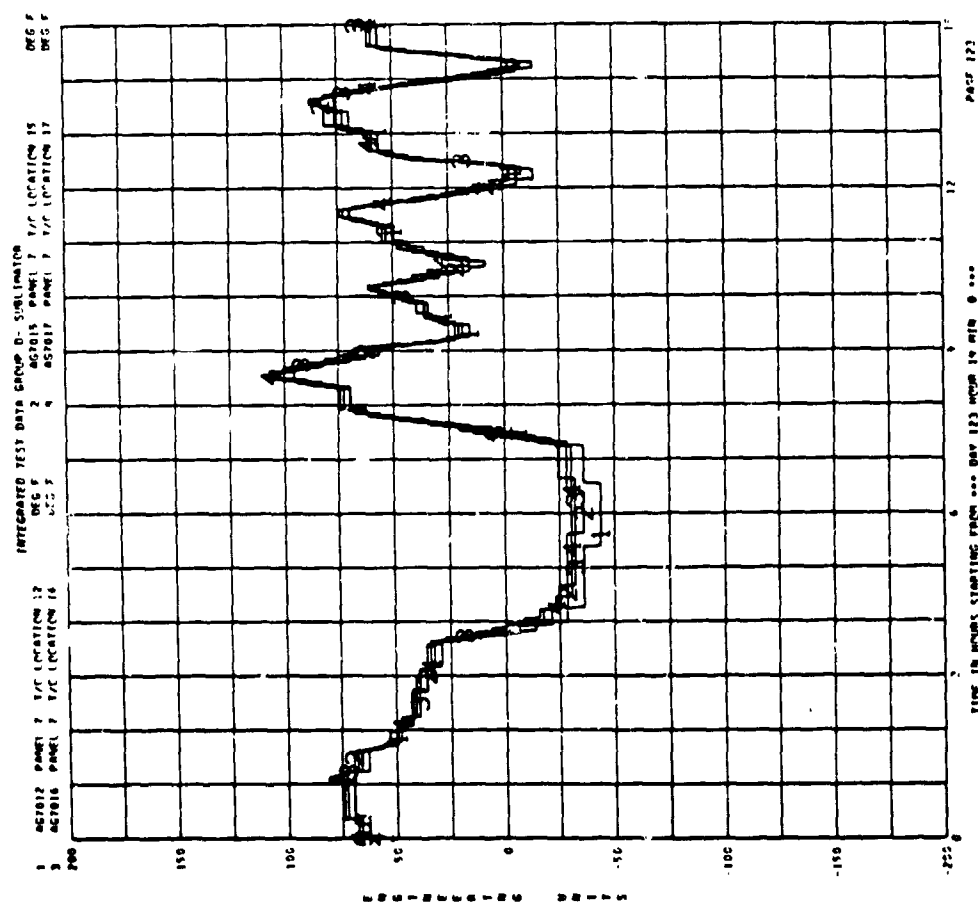
D-120



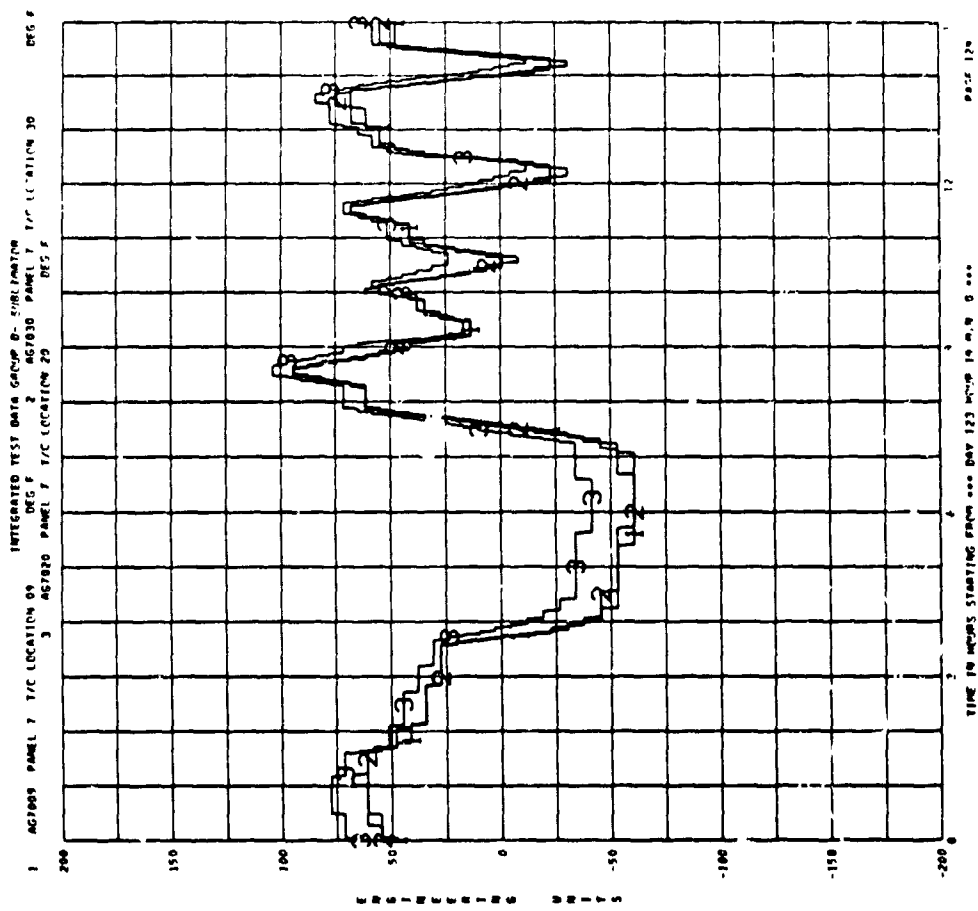
D-121



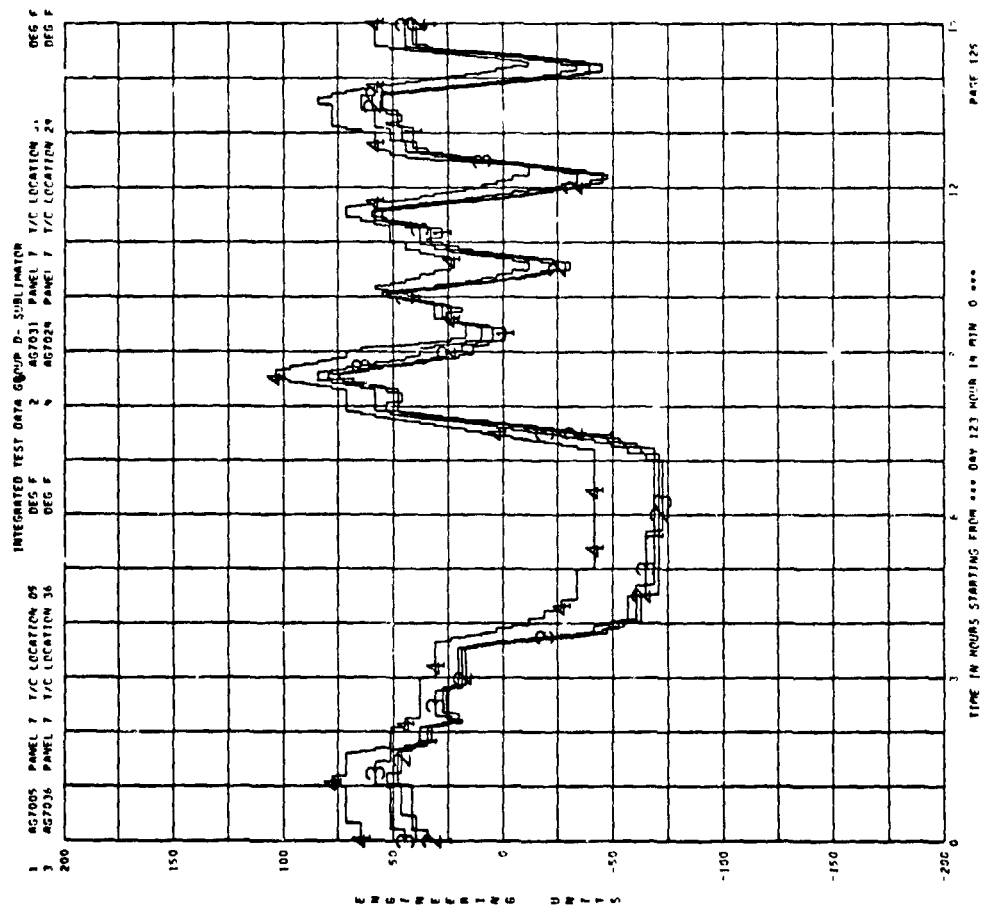
D-122



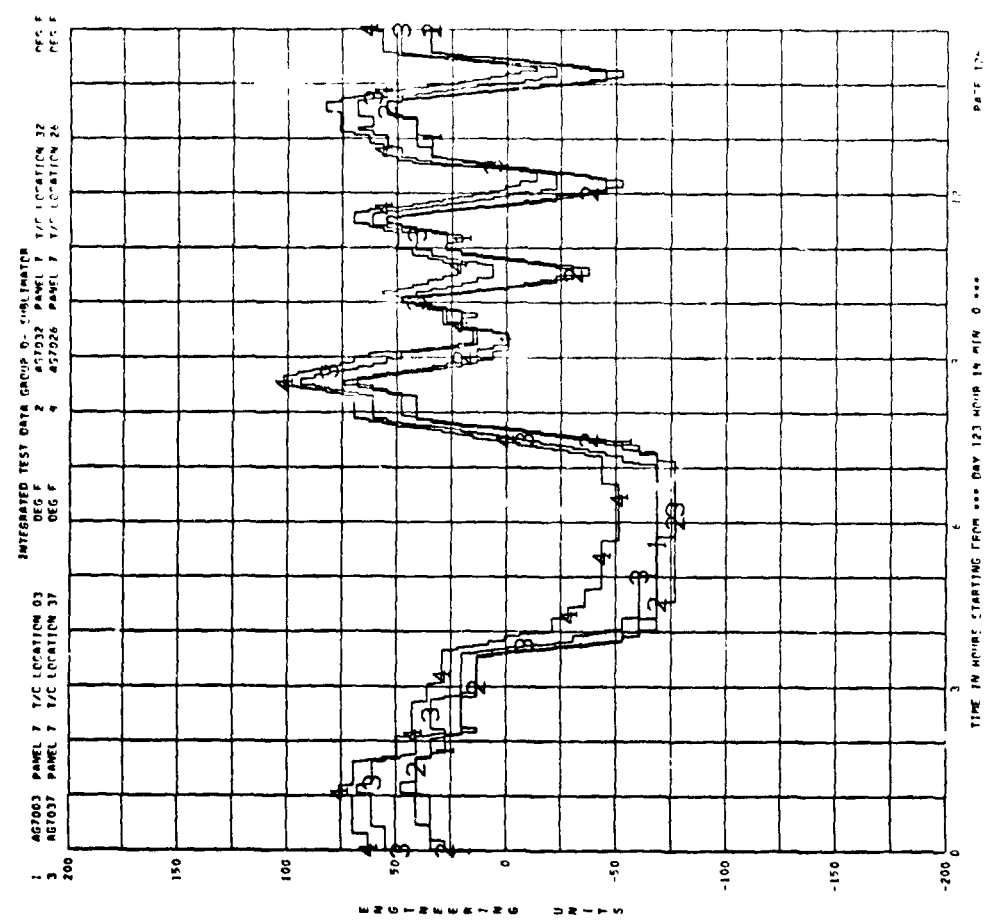
D-123



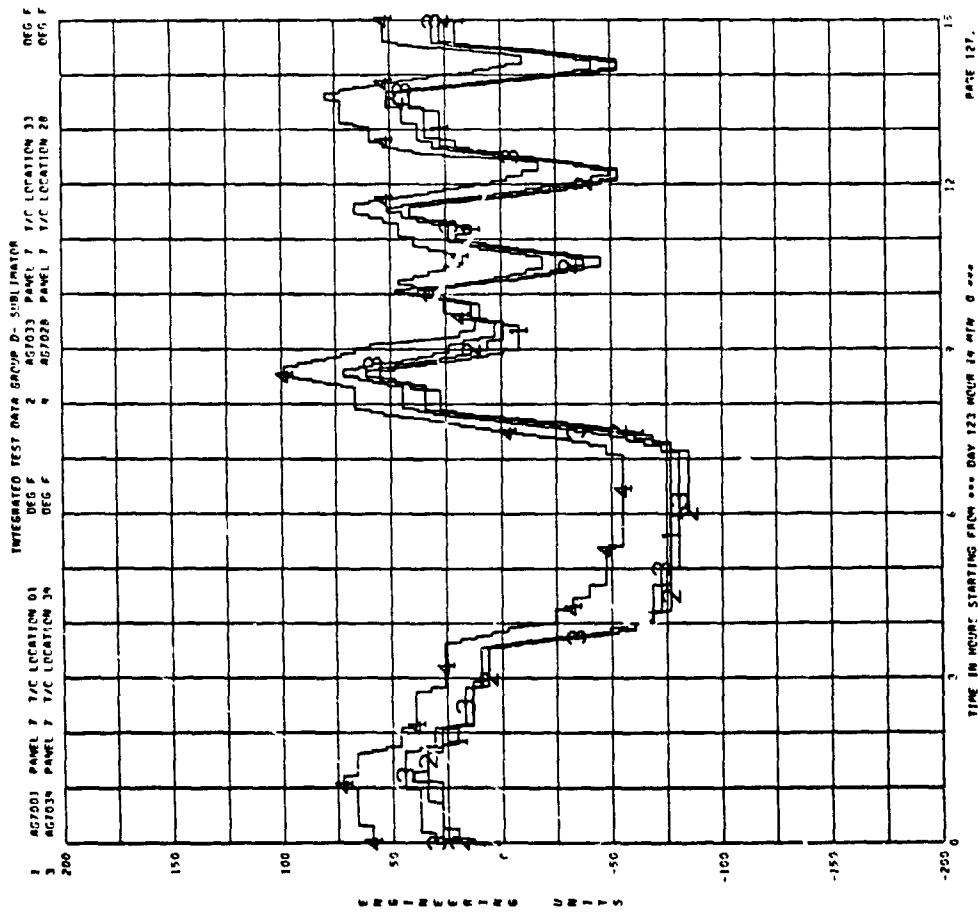
D-124



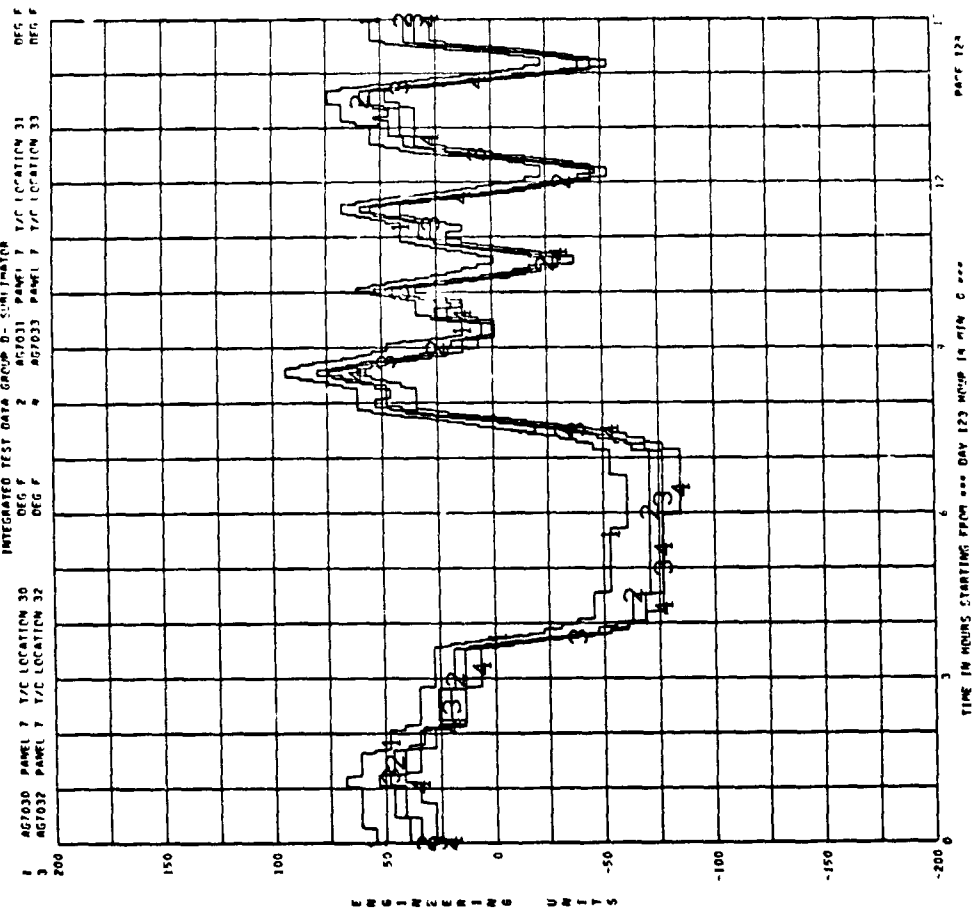
D-125



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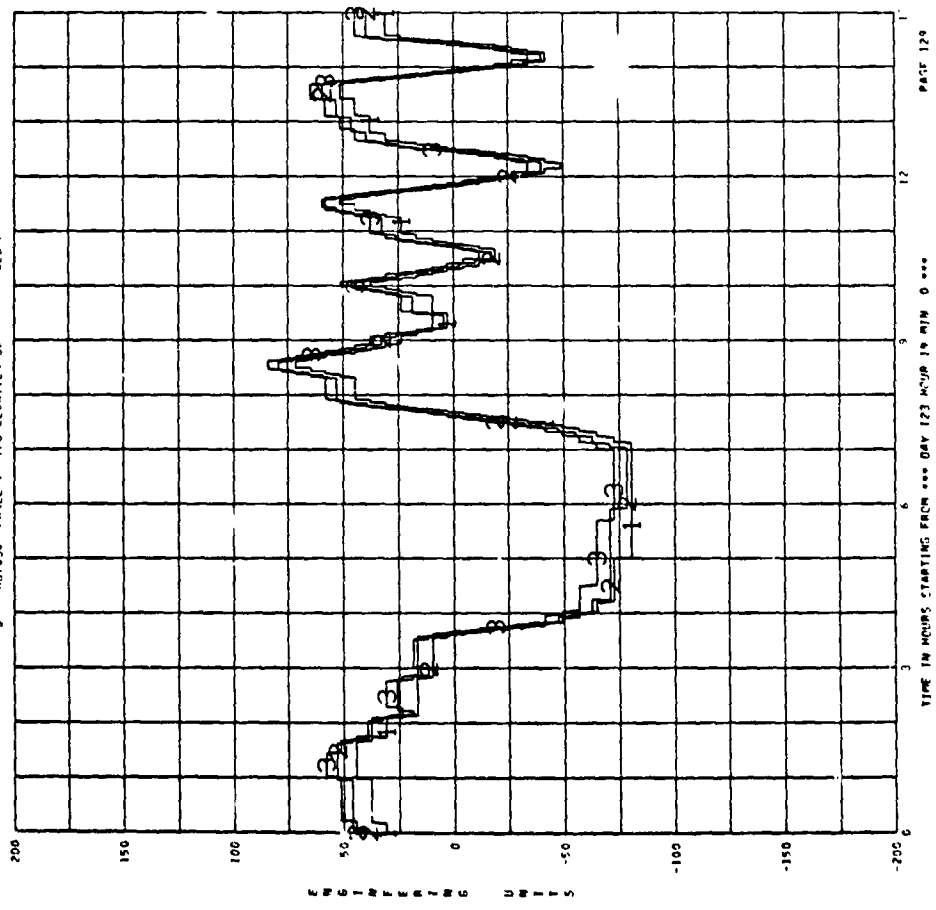


D-127



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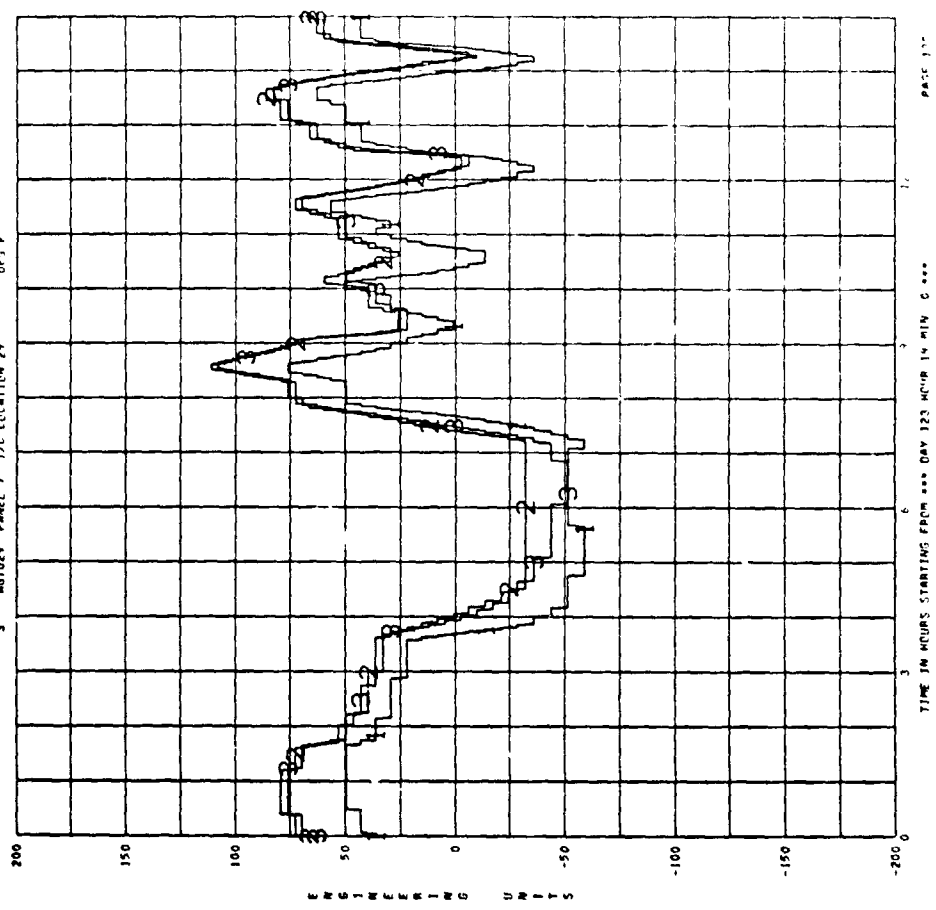
AG7034 PANEL 7 T/C LOCATION 34 DEG F
 2 AG7035 PANEL 7 T/C LOCATION 35 DEG F
 3 AG7036 PANEL 7 T/C LOCATION 36 DEG F



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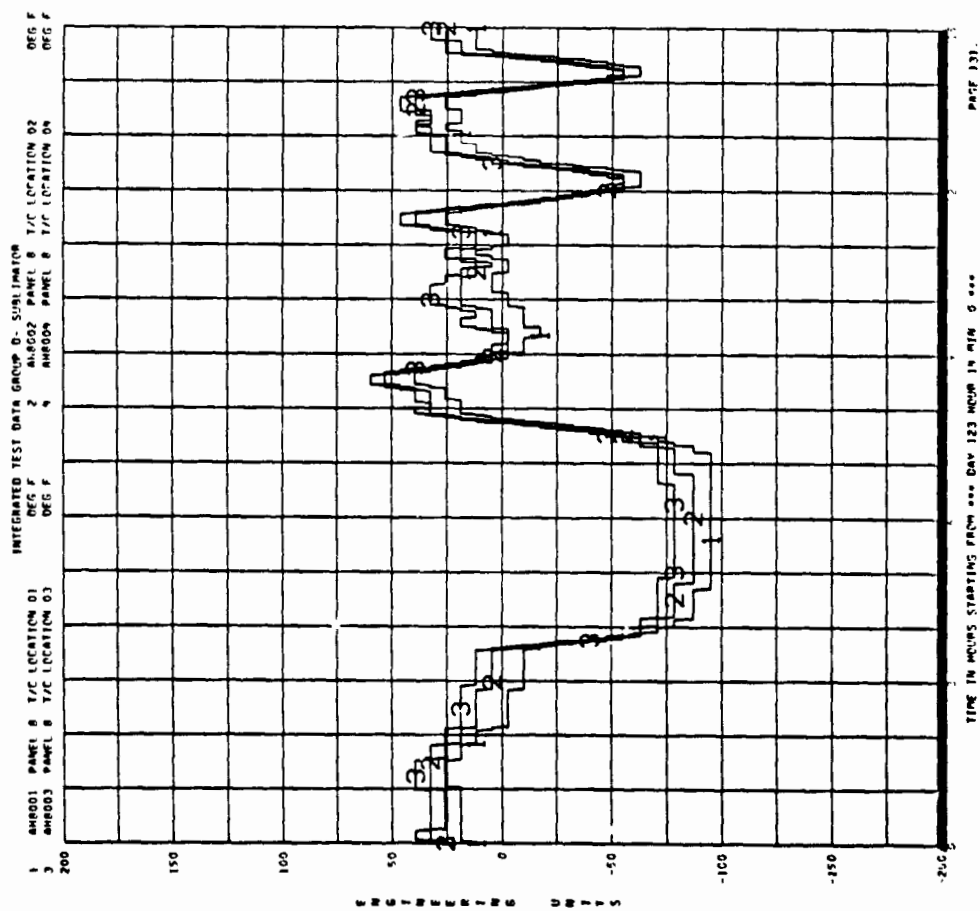
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AG7011 PANEL 7 T/C LOCATION 11 DEG F
 2 AG7018 PANEL 7 T/C LOCATION 18 DEG F
 3 AG7029 PANEL 7 T/C LOCATION 29 DEG F

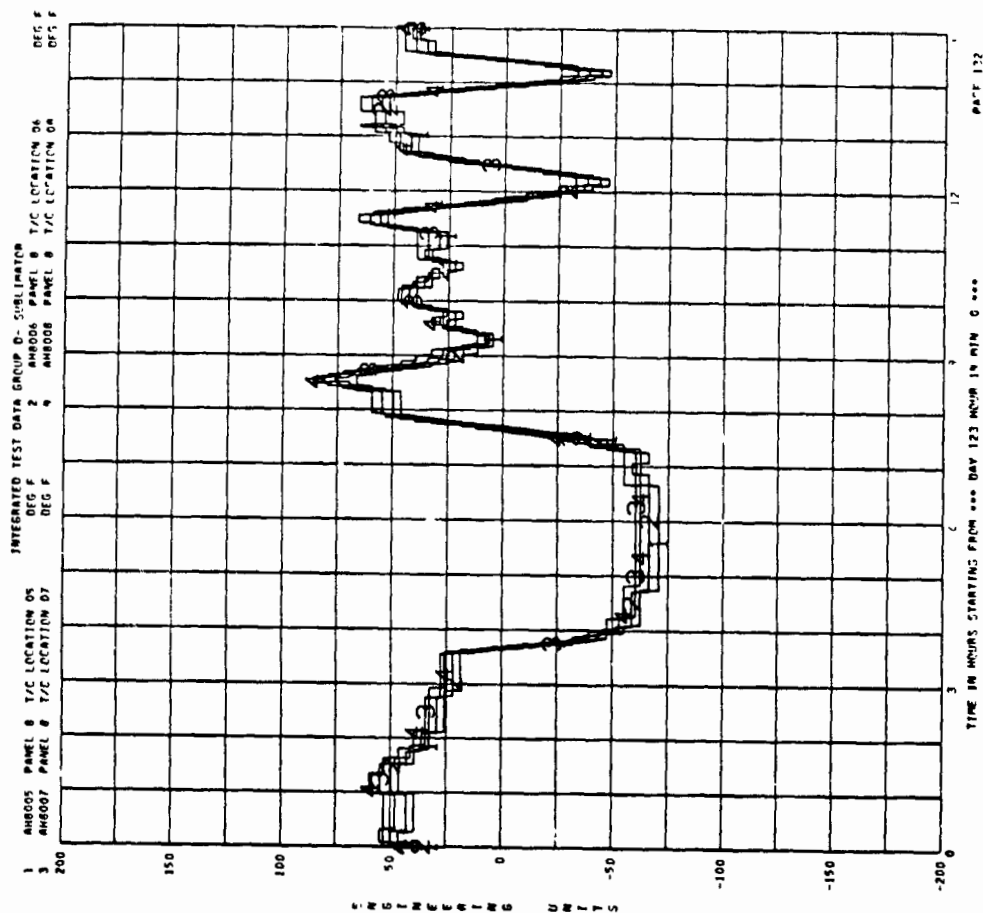


D-130

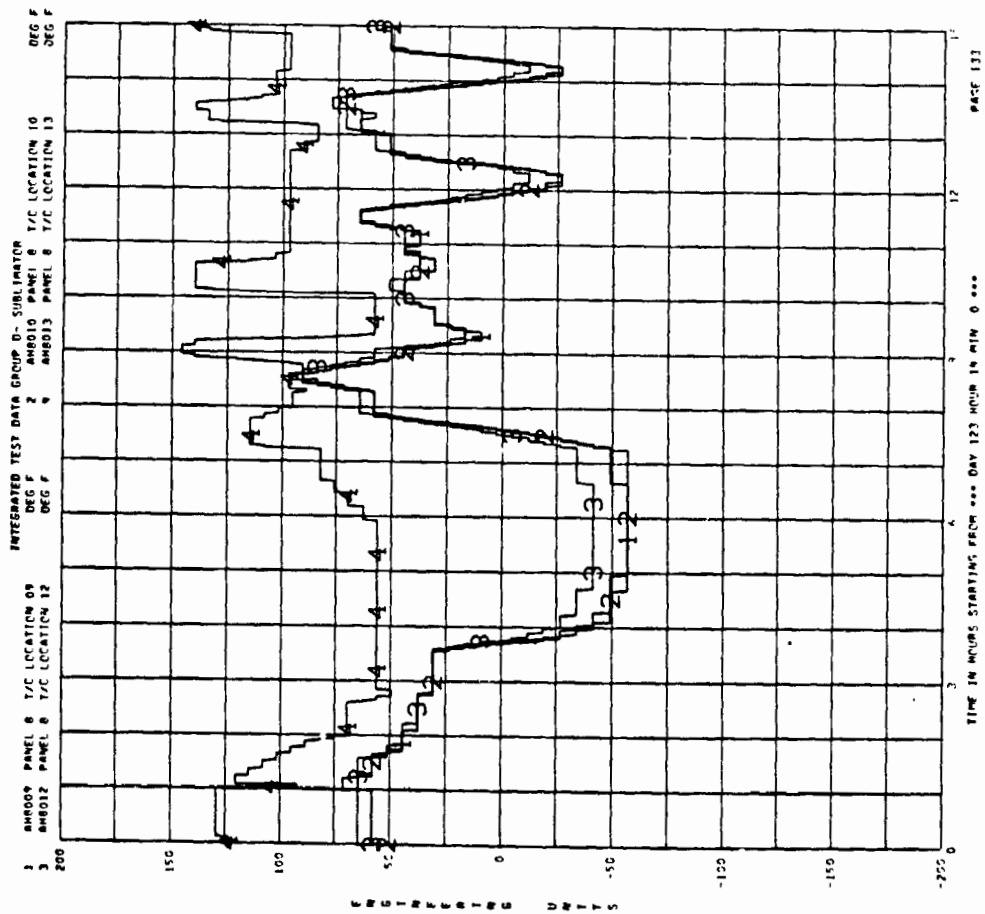
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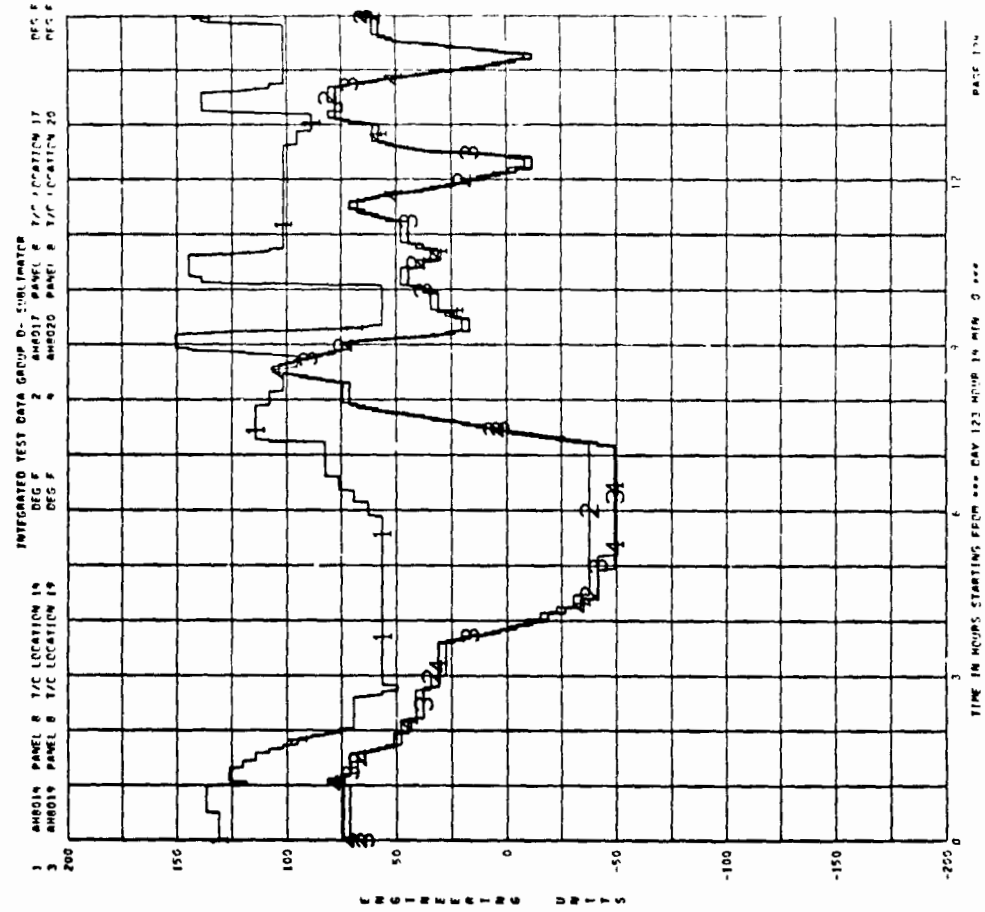
D-131



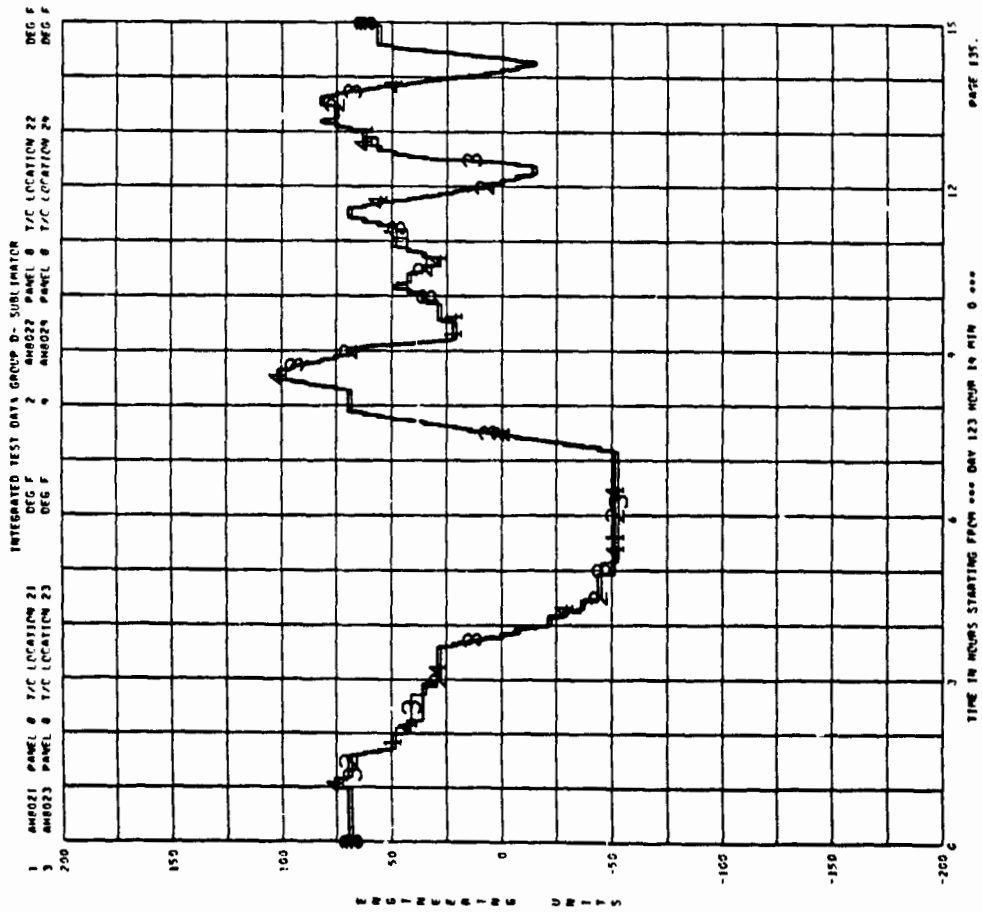
D-132



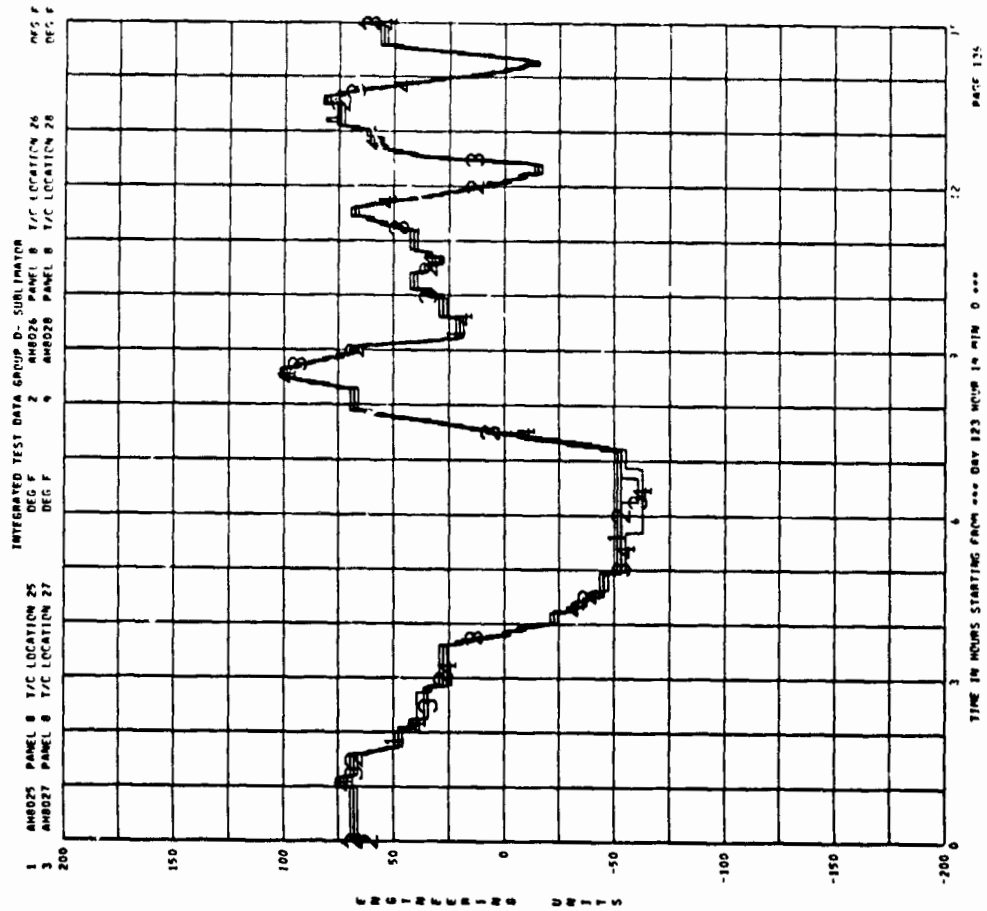
D-133



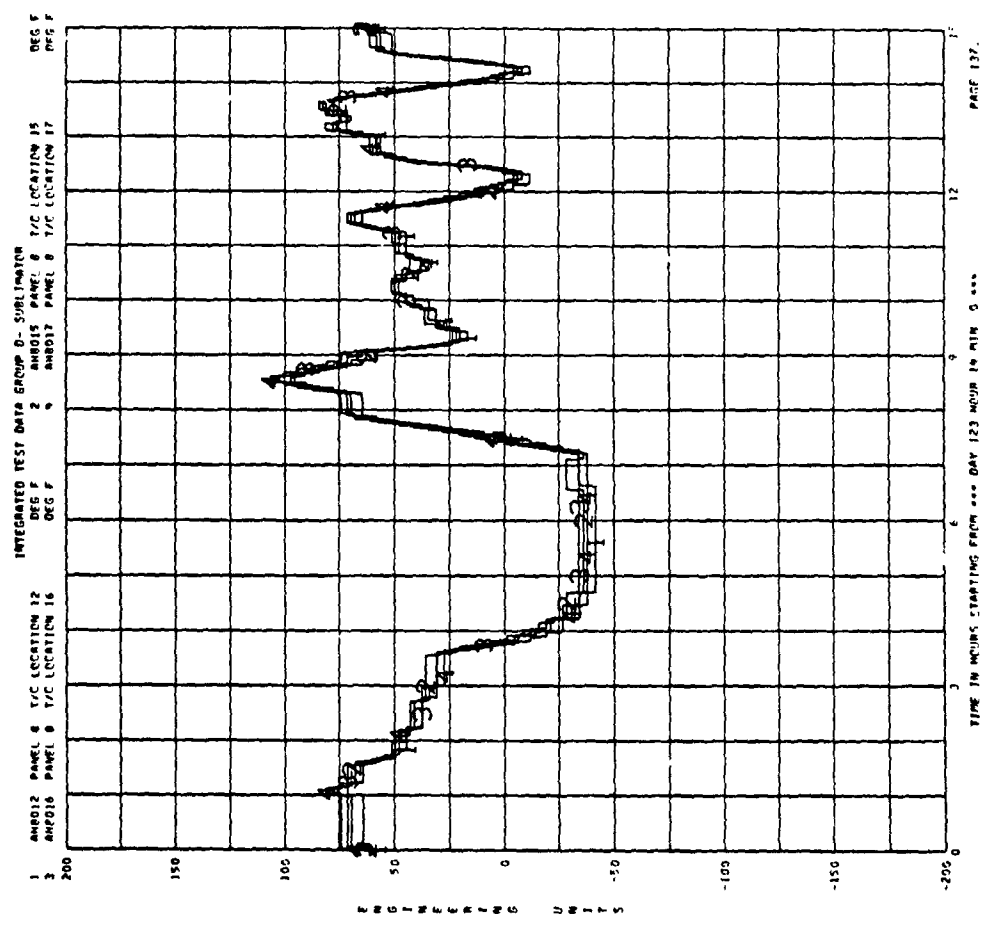
D-134



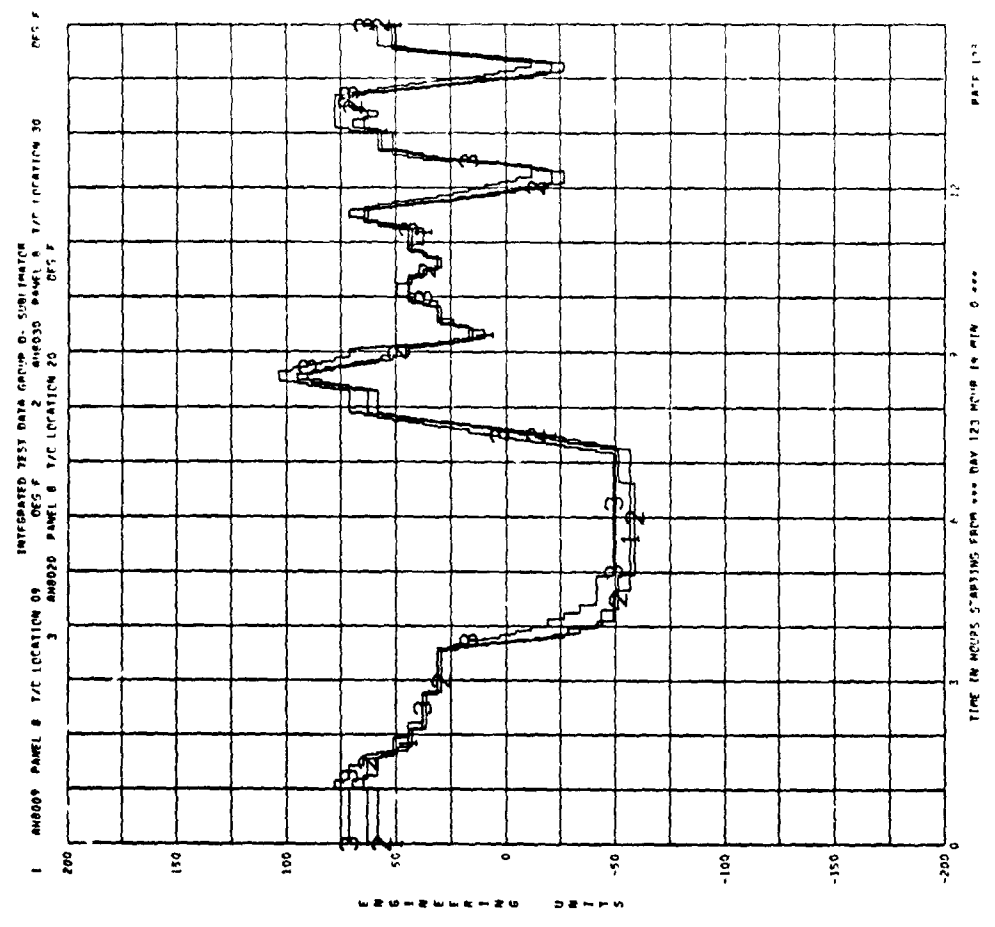
D-135



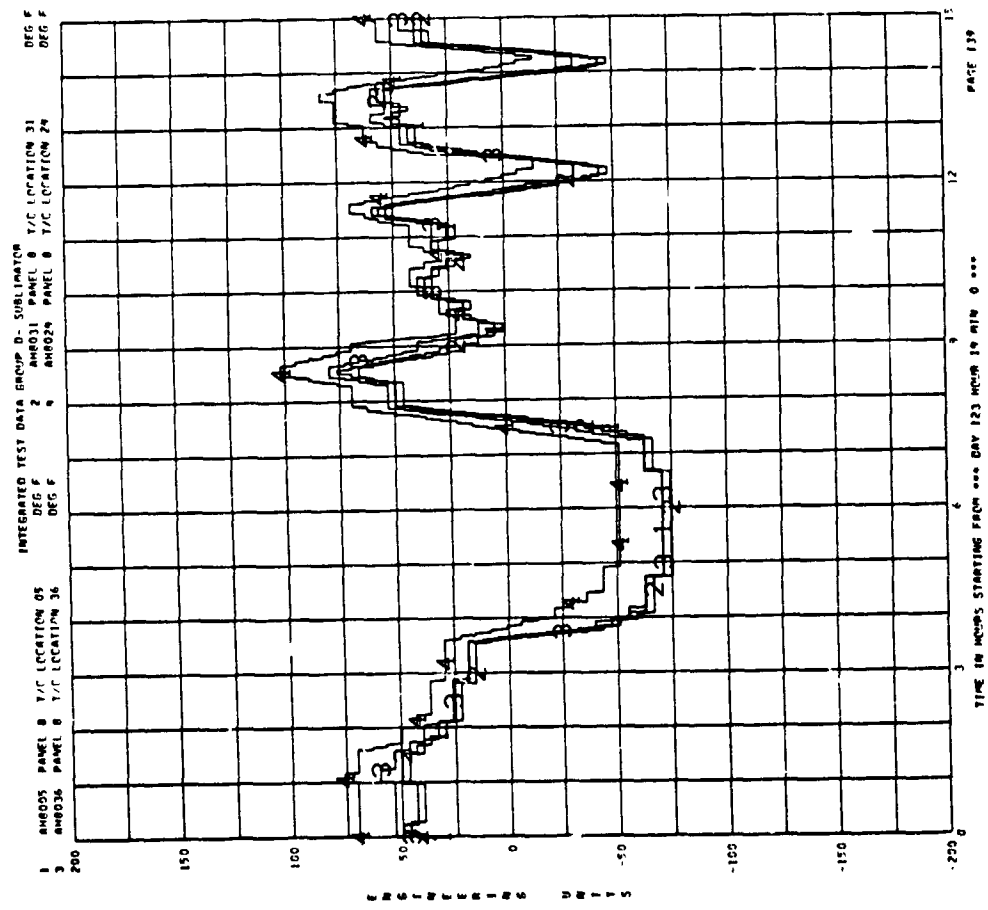
D-136



D-137

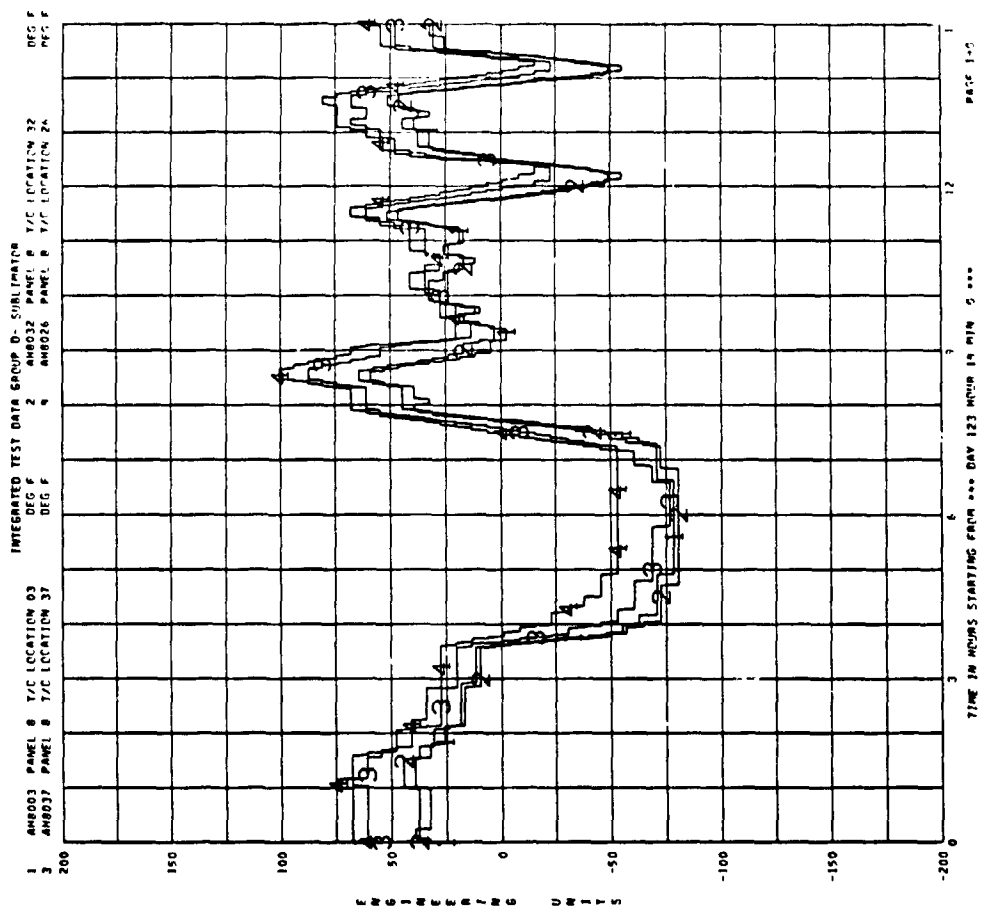


D-138



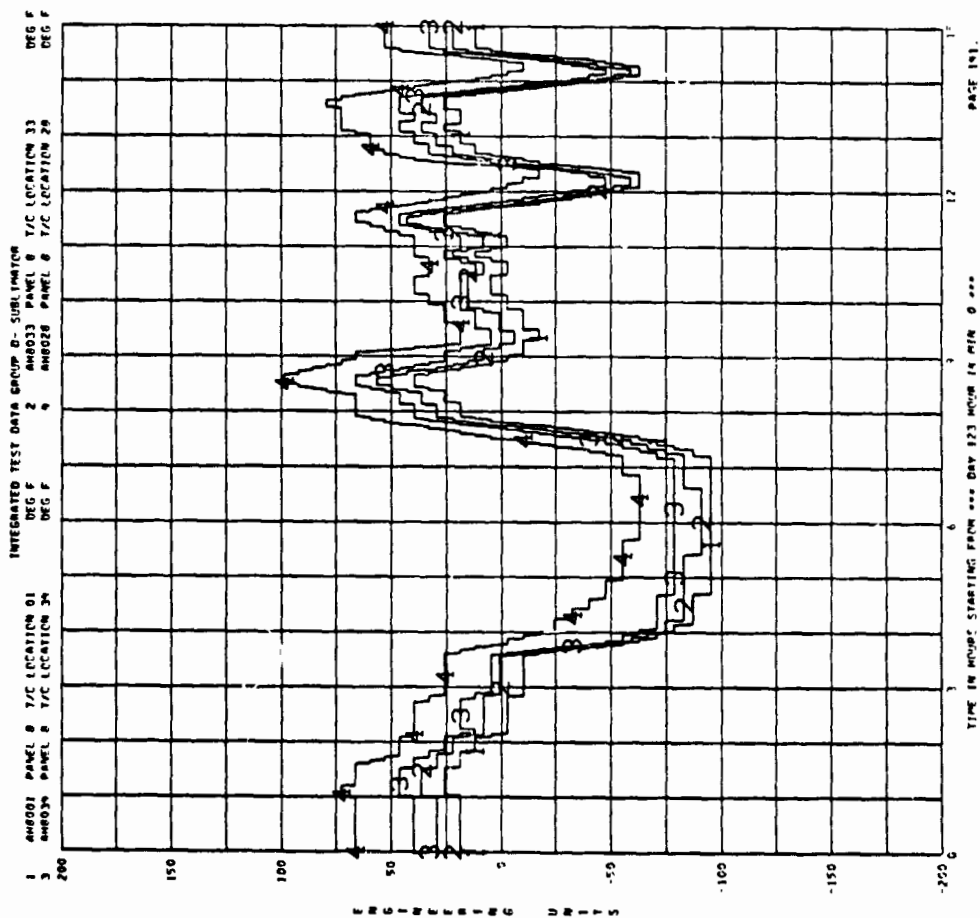
D-139

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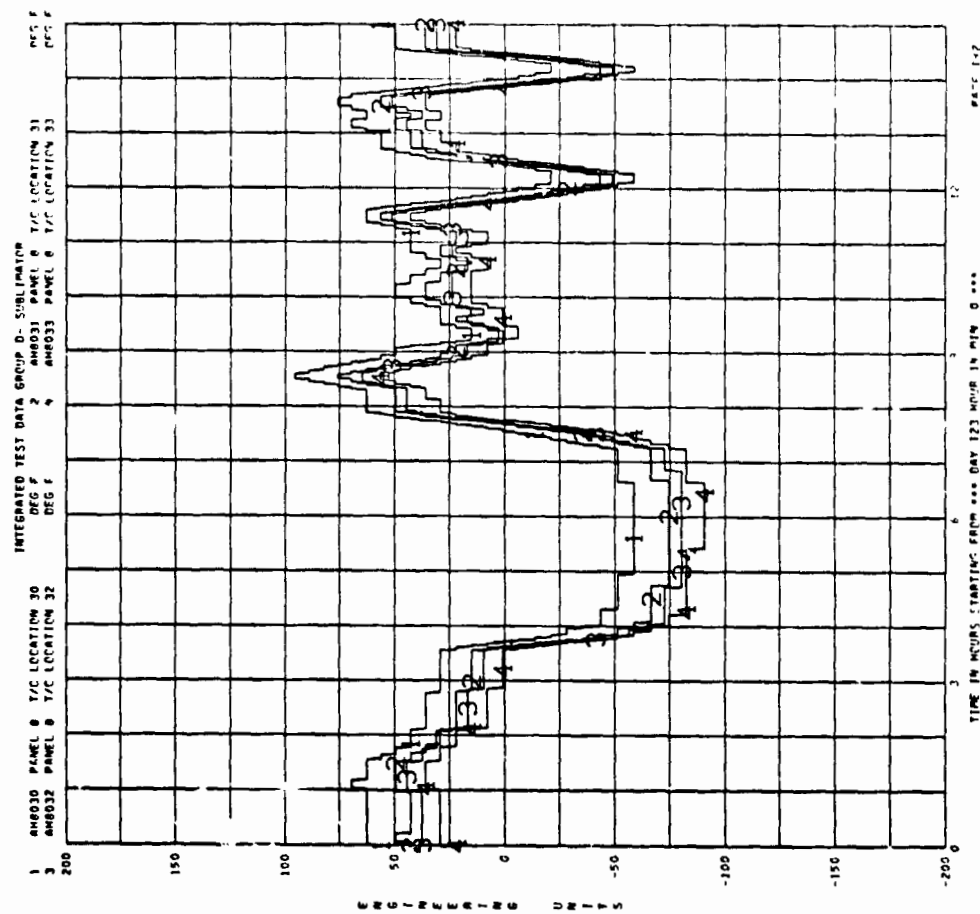


D-140

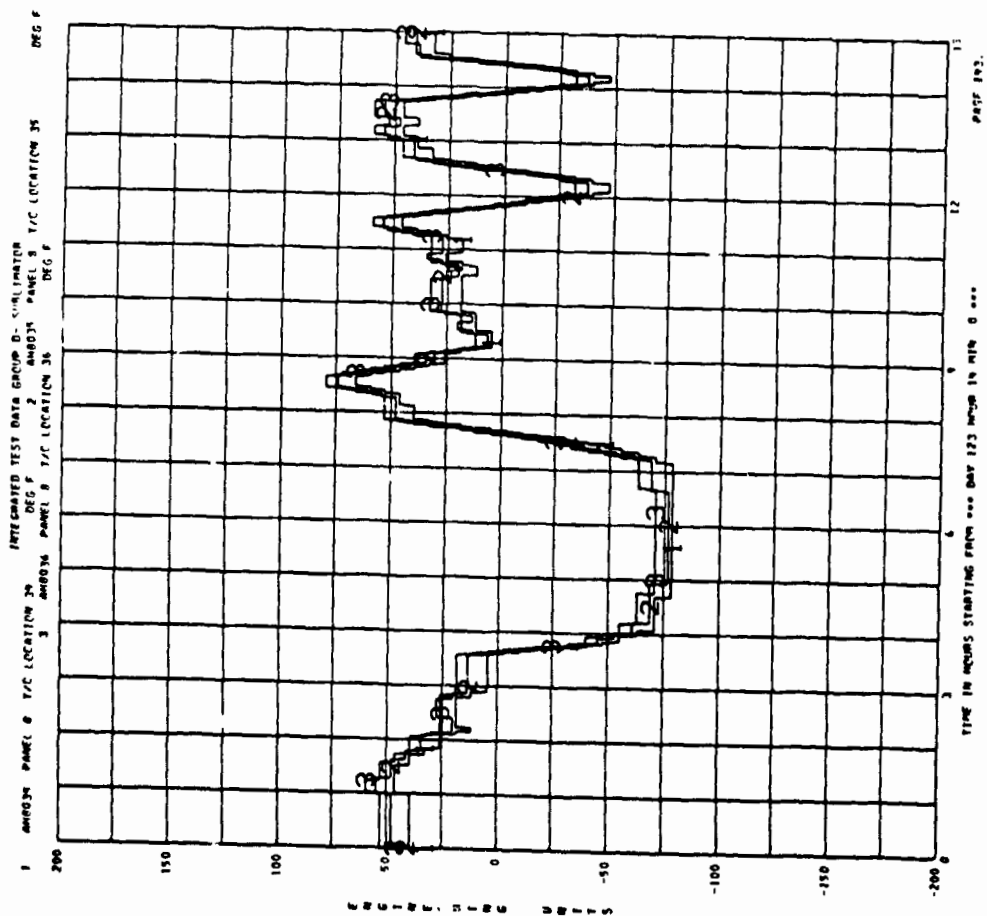
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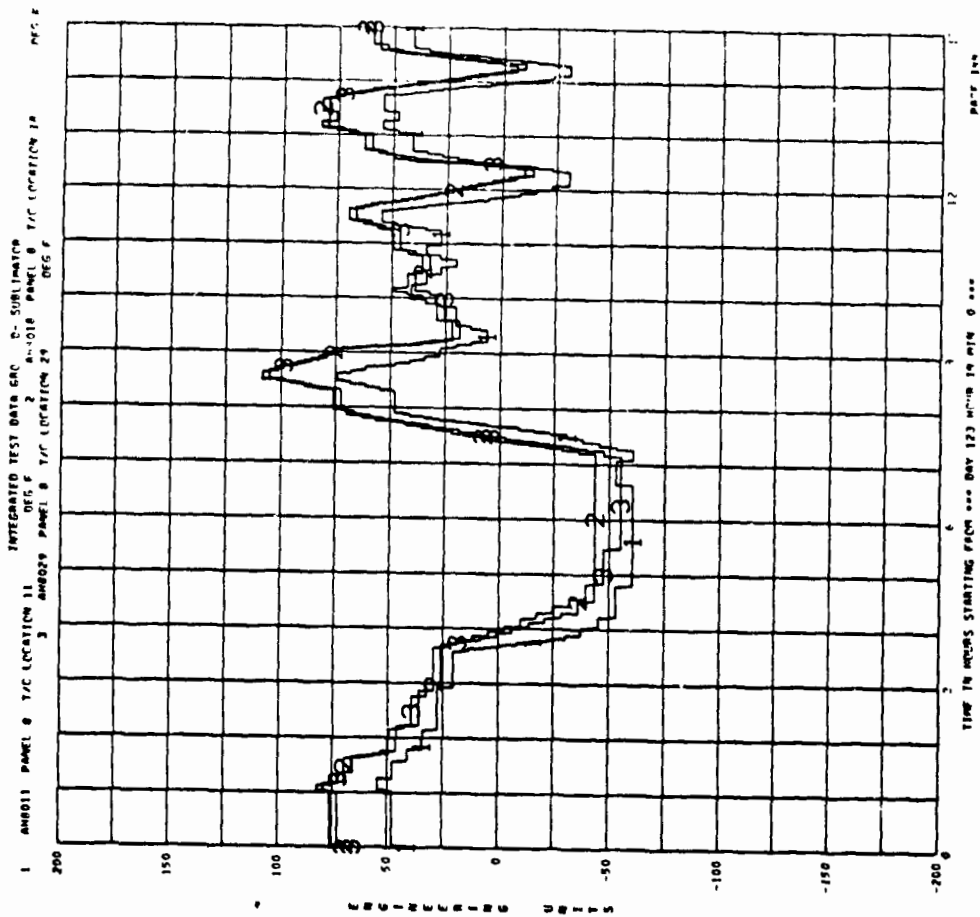
D-141



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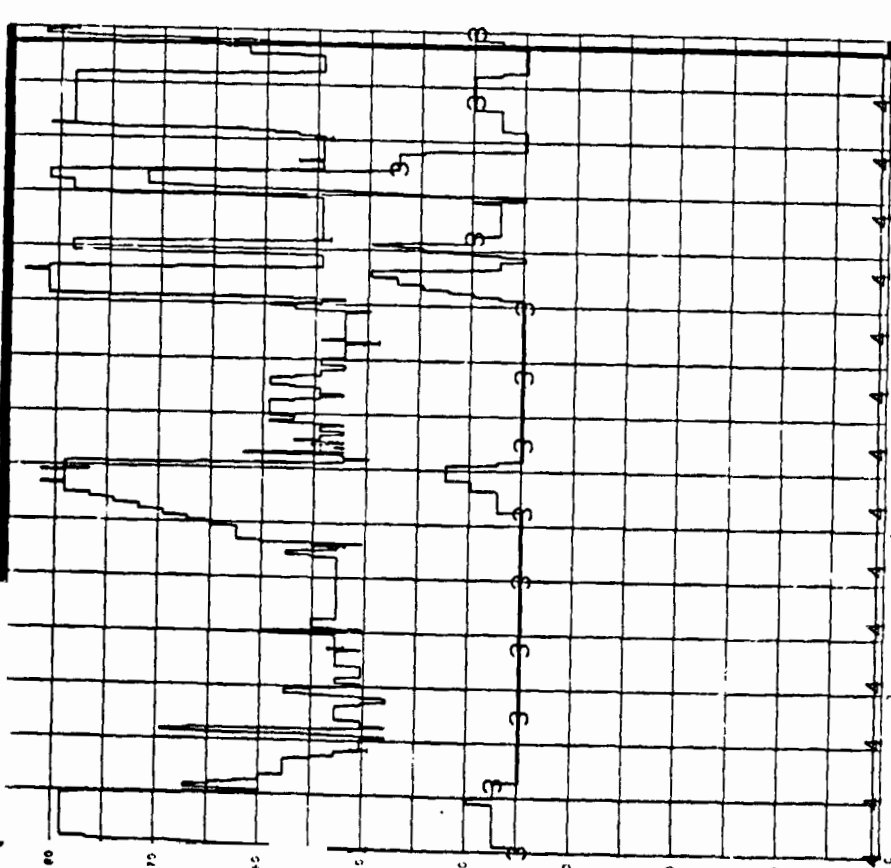


D-143



D-144

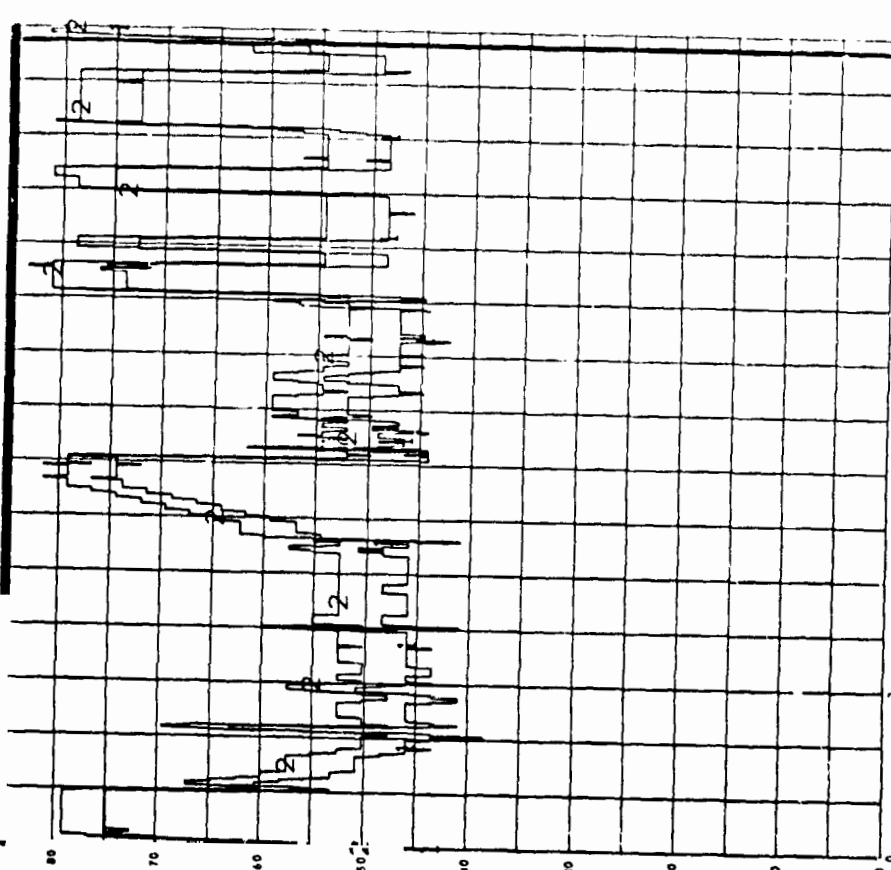
INTEGRATED TEST DATA GROUP D- SUBLIMATOR
 DEG F 1 AL0001 SUBL FREQ INLET TEMP NO 1 DEG F 2 AL0002 SUBL FREQ INLET TEMP NO 2 DEG F 3 AL0003 SUBL FREQ INLET TEMP NO 3 DEG F 4 AL0004 SUBL FREQ INLET TEMP NO 4



TIME IN HOURS STARTING FROM DAY 123 MIN 0

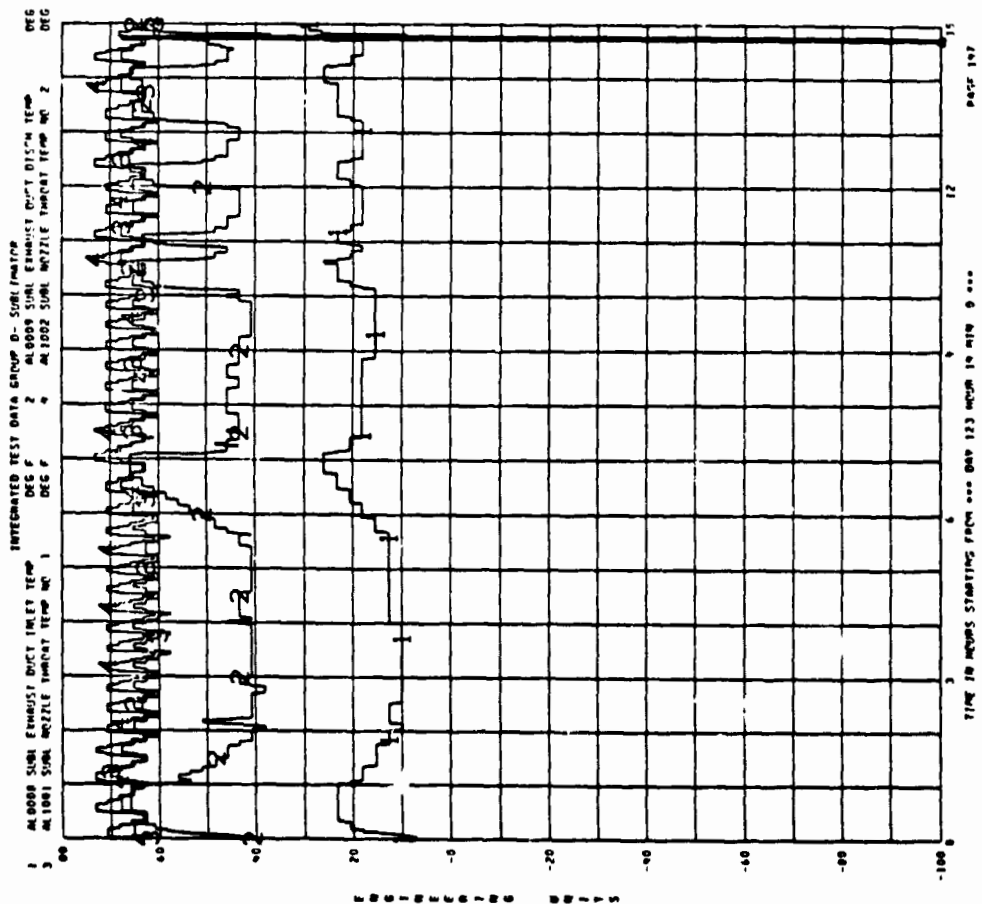
D-145

INTEGRATED TEST DATA GROUP D- SUBLIMATOR
 DEG F 1 AL0001 SUBL FREQ INLET TEMP NO 1 DEG F 2 AL0002 SUBL FREQ INLET TEMP NO 2 DEG F 3 AL0003 SUBL FREQ INLET TEMP NO 3 DEG F 4 AL0004 SUBL FREQ INLET TEMP NO 4

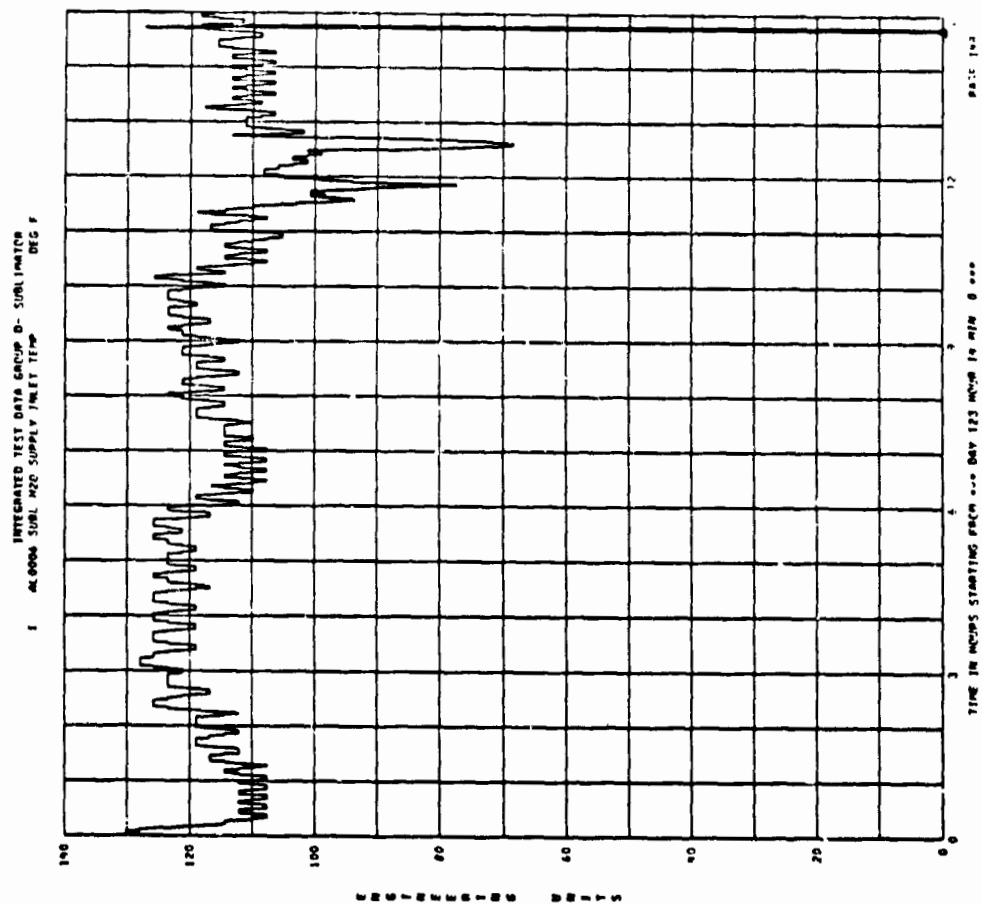


TIME IN HOURS STARTING FROM DAY 123 MIN 0

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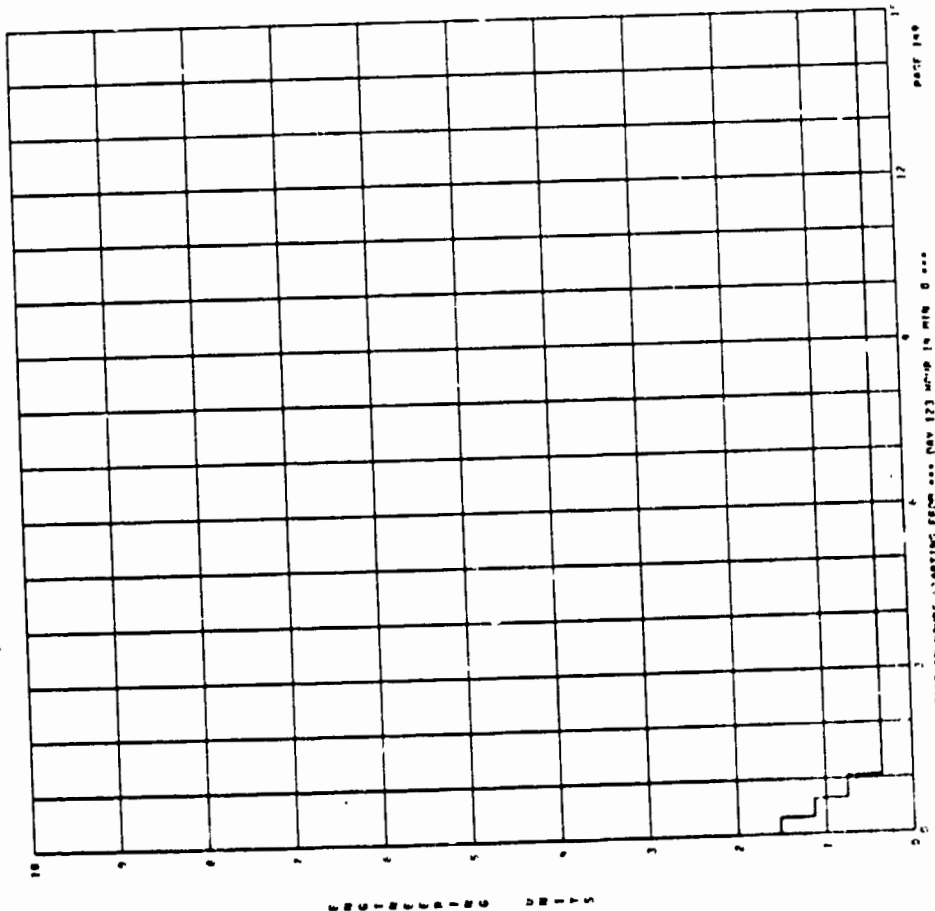


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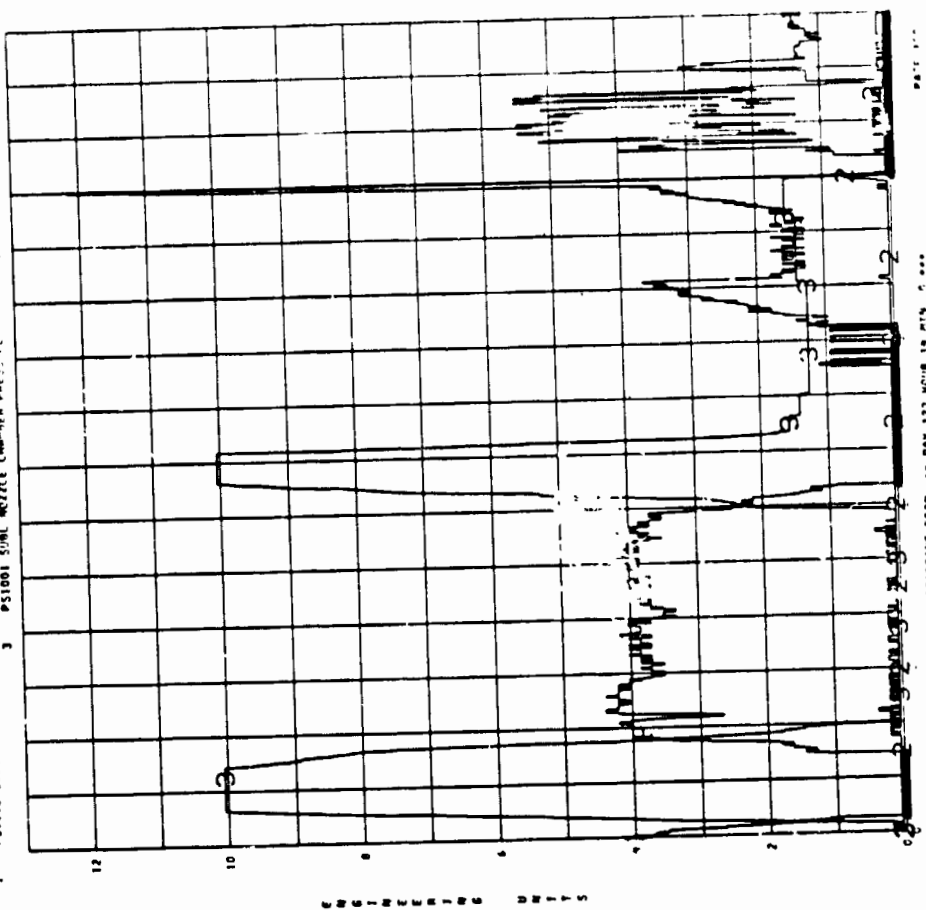
INTEGRATED TEST DATA GROUP D- SUNLIMITOR
 1 P50001 SUNL M20 SUPPLY INLET PRESSURE PSIA



TIME IN HOURS STARTING FROM 000 NOV 1973 HOUR 10 MIN 0 ...

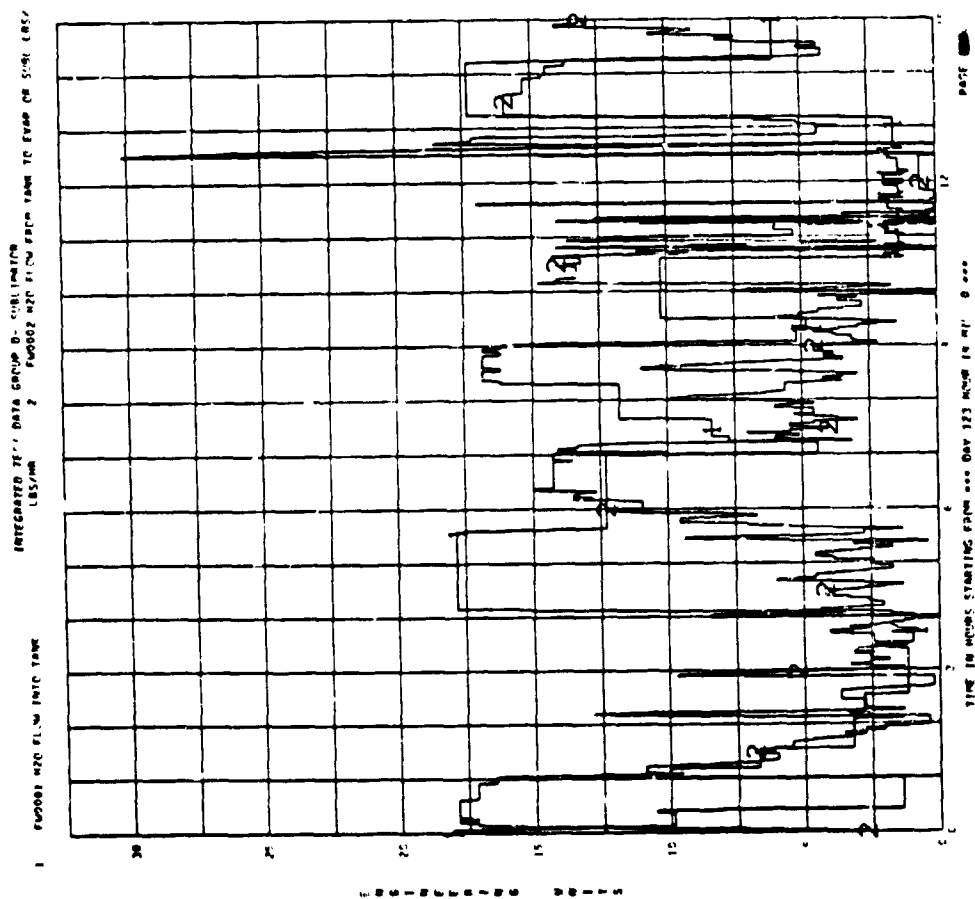
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INTEGRATED TEST DATA GROUP D- SUNLIMITOR
 1 P50002 SUNL EXHAUST DUCT INLET PRESSURE TORR
 2 P50003 SUNL EXHAUST DUCT INLET PRESSURE TORR
 3 P51001 SUNL NOZZLE CHAMBER PRESSURE TORR



TIME IN HOURS STARTING FROM 000 NOV 1973 HOUR 10 MIN 0 ...

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